APPRAISAL OF THE IMPLEMENTATION OF SUSTAINABILITY PRACTICES DURING CONSTRUCTION PHASE OF BUILDING PROJECTS IN AKWA IBOM STATE

BY

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NOVEMBER, 2016

DECLARATION

I hereby declare that this dissertation entitled: "Appraisal of the Implementation of Sustainability Practices during Construction Phase of Building Projects in Akwa Ibom State" has been written by me and it is the record of my own research work. It has not been presented in any previous application for a higher degree. All sources of information are specifically acknowledged using references.

Inimbom Walter Isang
November, 2016

CERTIFICATION

This dissertation entitled "Appraisal of the Implementation of Sustainability Practices during Construction phase of Building Projects in Akwa Ibom State by Inimbom Walter Isang (14/PG/EV/BT/002) meets the regulations governing the award of the degree of Master of Science (M.Sc.) of the University of Uyo and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to Jehovah God for giving me the strength to complete this work.

It is also dedicated to my Mother, Lady Ekaete Walter Isang.

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ABSTRACT

The implementation of sustainability practices depends in training building professionals and all segments of the society to become conscious of the way building projects are to be constructed to reduce environmental degradation, excessive resource consumption and carbon emissions. This research was aimed at assessing the level of implementation of sustainability practices during construction phase of building projects by building professionals in Akwa Ibom state, with a view to developing measures to improve its implementation on building site for building performance, resource efficiency and environmental conservation. Mixed research approach was used for the study. Data for this research was obtained through questionnaire and interviews. Four hypotheses were formulated to guide the study. Data were analysed using average percentages, relative importance index, mean item score, Kruskal Wallis and Mann-Whitney U test. The results showed that the awareness of sustainability practices by building professionals is high in Akwa Ibom State. Findings from the questionnaire survey revealed that choosing the right construction method for resource conservation and consideration of the client's satisfaction are the major sustainability practices that building professionals are aware of and are being implemented during building projects in the study area. Findings from the interviews showed that sustainability practices are subconsciously implemented on building projects. It was also revealed that regulation by the Government drives the implementation of sustainability practices, while client's resistance to change is the major barrier. Education and training programs for building professionals was found to be the most effective measure of improving the implementation of sustainability practices. The study recommended that education and training programs as well as Government regulations are needed to enable the successful implementation of sustainability practices in Akwa Ibom State.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Sustainable development has become the mainstream of the 21st century. Since the World Commission on Environment and Development (WCED) rose from the world summit on Environment in 1987 (Abolore, 2012), sustainable development as a concept has emerged. As such sustainability in all areas of human endeavours has been gaining increasing popularity across various sectors which have been in the process of interpreting and pursuing sustainability and sustainable development within their specific contexts (Abolore, 2012; Okoye and Okolie, 2013). Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Abolore, 2012). The construction industry has been viewed as a major contributor to human development and the overall quality of life through the provision of what is now deem life's essentials: shelter, water supply and sanitation, roads and railway networks.

Undoubtedly, however, the construction industry is one of the largest sectors in the world and indeed a significant industry. Its output worth more than $100bn a year, providing work for millions of people, and generating nearly 10% of gross domestic product (Willetts, Burdon, Glass and Frost, 2010; Dania, Larsen and Yao, 2013). Throughout its construction, operation and maintenance, the built environment contributes nearly 50% of all carbon emissions, 33% of landfill waste, and consumes 13% of raw materials and 50% of water (Willetts, Burdon, Glass and Frost, 2010). Without mincing words, these figures demonstrate the positive impact sustainability in the construction industry can have on development of the built environment and clearly shows why the industry needs to be a leader in embracing sustainability in order to

minimise its detrimental impact and mitigate negative impacts on future generations (Shen, Wu and Wang, 2001; Presley and Meade, 2010). Given the environmental, social and economic challenges facing current and future generations, it is imperative that the industry plays an active and leading role in guiding the development process towards sustainability because it is considered that the proper development and operation of a construction project can make significant contribution to the mission of sustainable development. Al-yami and Price (2006) opined that the term sustainability in construction is generally used to describe the application of sustainable development in the construction industry. Sustainability in construction is all about following suitable practice in terms of materials, their sources, construction methodologies as well as design philosophy so as to be able to improve performance, decrease the environmental burden of a project, minimise waste and be ecologically friendlier (Abolore, 2012).

Shen, Tam, Tam, and Ji, (2010) agreed that sustainability in construction practice refers to various methods in the process of implementing construction projects that involve less harm to the environment, increased reuse of waste in the production of construction material (prevention of waste production and waste management), beneficial to the society, and profitable to the company. Kashyap, Khalfan and Zainul-Abidin (2003) observed that all existing definitions of 'sustainability in construction' still acknowledged that even if it were attained, construction operations would continue to have environmental impacts, although at a reduced rate. Sustainability in construction is still too often equated with "green building" (Rahim, Muzaffar, Yusoff, Zainon and Wang, 2014) however, sustainability principle is based not only on the pillar of environmental but also on economic and social pillars (Adetunji, Price, Fleming and Kemp 2003; Al-Yami and Price, 2006; Subramanian, 2007; Abolore 2012; Hussin, Rahman and Memon,

2013). Some approaches focus only on the environmental or social or economic dimensions, this study will treat all three aspects together. According to Adetunji, Price, Fleming and Kemp (2003), economic sustainability is the industry's contribution towards maintenance of high and stable levels of economic growth and employment through increased productivity and improved project delivery. Environmental sustainability addresses the impact of construction activities on the environment and propagates the prevention of harmful and potentially irreversible damage to the environment through efficient use of natural resources, waste minimization, and energy and water efficiency. Social sustainability deals with legal, moral and ethical obligations of the construction industry to its stakeholders such as employees, suppliers and the community in which it operates. The goal of sustainability is to guide the economic and social forces of the earth's nations to live within the goods and services provided by the ecosystems without reducing the availability of these goods, services and energy sources for future generations (Abolore, 2012).

There are few studies in Nigeria that have focused on the issue of sustainability in construction. Among those works are the studies of Abolore (2012), Dania, Larsen and Yao (2013) and Olonade (2015). Dania, Larsen and Yao (2013) indicated that sustainability in the construction sector has been a key theme globally for close to two decades now, but in Nigeria sustainability issues amongst practicing professionals was found to be deficient due to problems concerning a cohesive understanding and awareness of sustainability issues. This was also reiterated by Abolore (2012) who revealed that in a developing country like Nigeria, there is a low awareness level of sustainability concept due to lack of understanding, lack of awareness and individual commitment to construct sustainably, lack of political will and no bye-law or regulation by the government to enforce sustainability. This should make professional

practitioners in the construction industry to become conscious of the role of sustainability. However, the specific study areas of Abolore (2012) and Dania, Larsen, and Yao (2013) were Lagos and Abuja respectively. As such, it is important for a carefully designed scientific inquiry to be conducted regarding the implementation of sustainability practices on building projects in Akwa Ibom State. This is with a view to improving building performance, resource efficiency and environmental conservation.

1.2 Statement of the Research Problem

With growing concerns for the environment and climate change, there has been a focus on the way new structures are commissioned and built; particularly in their use of energy and resources. According to Shen, Wu and Wang (2001), construction activity is commonly considered to have adverse impacts on the environment, which is the basis of sustainable development for human being. During construction activities, large quantities of natural resources are consumed, water is used extensively, much waste is generated, greenhouse gases are emitted and a wide range of ecosystem is destroyed. Buildings account for CO_2 emissions and consume huge amounts of energy across a lifecycle that spans production, construction, operation and demolition (Lafarge 2015; Olonade, 2015). Hussin, Rahman and Memon (2013) observed that traditional practices of construction process and management were found to be unable to control unprecedented challenges including the carbon emission issue by buildings which have contributed to the global warming and extreme weather change all over the world. With recent, unprecedented climate changes from global warming becoming more adverse worldwide, discussions by the international community for establishing an appropriate response policy against climate change have become more urgent (Tae and Shin, 2009). Although climate change is one major concern, so too are the unsustainable use of natural resources, the increasing scarcity of water, and the ever-increasing volume of

waste. Olonade (2015) attributed the reports of incessant building collapses in Nigeria as an indicator that much is still needed in sustaining our construction activity; where buildings collapse and rubble from the collapse buildings are disposed of indiscriminately, posing a threat to the environment. Dania, Larsen and Yao (2013) argued that “Nigeria is lagging behind world developments associated with sustainability within the construction sector”. Olonade (2015) and Abolore (2012) observed that unless drastic efforts are made to counter the negative aspect of executing construction works in conventional ways which do not take sustainability into consideration and are not environmentally friendly, more harm than good will continue to come from our quest for infrastructural development.

Abolore (2012) particularly opined that with the growing awareness on environmental protection due to the depletion of non-renewal resources, global warming and extremity of destruction to ecology and biodiversity impact, many efforts are being directed to build sustainably in the construction world. The author further indicated that the sure way to mitigate these destructive and damaging activities is to welcome the philosophy of sustainability in construction. According to Tan, Shen and Yao (2011), the presence of cost increase, time consuming activities and resource consumption for implementing environmentally friendly construction practices discourages contractors from engaging actively in improving their sustainability performance. Al-Yami and Price (2006) observed that there are several potential barriers to the implementation of sustainability in construction with the main one being perceived cost. The common perception about sustainability in construction project compared to traditional building projects appears to be the risk of unforeseen high cost. This barrier can be overcome by moving the thinking of stakeholders from cost (Isang, 2011) to value and from short-term to long-term.

The benefits of sustainability practices needs to be disseminated to building professionals as well as to clients. The construction industry must inevitably change its historic methods of operating with little regard for environmental impacts to a new mode that makes environmental concerns a centre-piece of its efforts. While the concept of sustainability in construction has become popular in research, there is little existing work on the implementation of sustainability practices during construction phase of building projects in Akwa Ibom State. As such, there are some unanswered questions in a carefully designed scientific inquiry as it relates to the implementation of sustainability practices in building projects. Therefore, this study provides a useful snapshot of building professional's understanding and level of implementation of sustainability practices during the construction phase of building projects. It also sheds light on the level of awareness, the drivers, barriers, and measures of improving the implementation of sustainability practices in order to improve building performance, enhance resource efficiency and conserve the environment.

1.3 Research Questions

The following research questions were developed based on the research problem of the study:

1. What is the level of awareness of sustainability practices during construction phase of building projects by building professionals?
2. What is the level of implementation of sustainability practices during construction phase of building projects?
3. What are the drivers of implementing sustainability practices during construction phase of building projects?
4. What are the barriers to implementing sustainability practices during

construction phase of building projects?

5. What are the measures of improving the implementation of sustainability practices during construction phase of building projects?

1.4 Aim and Objectives of the Study

The aim of this research was to assess the level of implementation of sustainability practices during construction phase of building projects by building professionals in the study area, with a view to developing effective measures to improve its implementation on building site for improved building performance, resource efficiency and environmental conservation. The specific objectives of this research were to;

1. examine the level of awareness of sustainability practices during construction phase of building projects by building professionals;

2. investigate the level of implementation of sustainability practices during construction phase of building projects;

3. determine the drivers for implementing sustainability practices during construction phase of building projects;

4. investigate the barriers of implementing sustainability practices during construction phase of building projects; and

5. develop measures of improving the implementation of sustainability practices during construction phase of building projects.

1.5 Hypotheses of the Study

The following were the hypotheses formulated for the study:

1. H_O: There is no significant variation in the perception of the level of awareness of sustainability practices during construction phase of building projects among

Builders, Architects, Engineers and Quantity Surveyors in the study area.

2. H_0: There are no significant differences in the perception of the level of implementation of sustainability practices during construction phase of building projects among Builders, Architects, Engineers and Quantity Surveyors in the study area.

3. H_0: There is no significant variation in the perception of the drivers for sustainability practices during construction phase of building projects among Builders, Architects, Engineers and Quantity Surveyors in the study area.

4. H_0: There are no significant differences in the perception of the barriers of sustainability practices during construction phase of building projects among Builders, Architects, Engineers and Quantity Surveyors in the study area.

1.6 Significance of the Study

This research contributed to knowledge on the level of awareness and implementation of sustainability practices during construction phase of building projects as well as the drivers and barriers of sustainability practices, and by developing measures to improve the implementation of these practices. For the level of awareness of sustainability practices, the outcome of this study enabled building professionals and clients to gain knowledge of this new way of building and be more conscious of sustainable practices. The outcome of examining the level of awareness of sustainability practices also enabled building professionals and clients to gain knowledge of this new way of building and be more conscious of practices that can sustain construction activities in the state. Knowing but not implementing is a major issue, for this reason, investigating the implementation of sustainability practices to see the level it is being carried out in the study area, benefited building professionals as they can now incorporate

sustainability practices into their professional practice with particular focus on how these practices can be used to execute building projects to reduce waste, minimise polluting emissions to the air, soil and water on human health during construction activities and conserve the natural environment. By determining the drivers, the government and clients were now able to realise the factors that drives the implementation of these practices. Investigating the barriers assisted building professionals to identify the factors that hinder its implementation. Developing measures of improving sustainability assisted professionals and clients so that when confronted with barriers, they can use the measures to improve the implementation of sustainability practices in their building projects for improved building performance, resource efficiency and environmental conservation. This research was also significant in that it compared the perception of Builders, Architects, Engineers and Quantity Surveyors on sustainability practices on building projects in Akwa Ibom State.

1.7 Scope and Delimitations of the Study

The study was carried out in the three senatorial districts of Akwa Ibom State. This dissertation assessed the level of implementation of sustainability practices with the focus limited to building projects executed in the public and private sectors by registered building professionals operating in the study area.

CHAPTER TWO

REVIEW OF RELATED LITERATURE AND CONCEPTUAL FRAMEWORK

2.1 Preamble

This chapter presented the review of related literature in line with the objectives of the study. It covered a brief overview of sustainable development, the concept of sustainability in construction and its benefits. Also reviewed were the level of awareness of sustainability practices, the level of implementation of sustainability practices, sustainability practices during construction phase of building projects, the drivers, barriers as well as the measures that can be used to improve the implementation of sustainability practices on building projects. The conceptual and theoretical framework underpinning the study, and the gaps in knowledge concluded the chapter.

2.2 Overview of Sustainable Development

The quest for sustainable development puts the spotlight on the built environment and the construction industry, and calls for far reaching changes in the way construction is carried out. Construction of buildings and infrastructure are the main consumers of resources; materials and energy (Hussin, Rahman and Memon, 2013), moreover pollution, environmental degradation and natural resource depletion have been on the increase and these are crucial to the long term future of humanity. The World Commission on Environment and Development remarked that the essential needs of vast number of people were not being met and warned that a world where poverty and inequity were endemic would be prone to ecological and other crisis (Abolore, 2012). During the United Nations Environmental Programme in 1992, Sustainable Development was defined as "Improving the quality of human life while living within the carrying capacity of supporting eco-systems" (Shafii, Ali and Othman, 2006). This definition has an impact on the economic, social and environmental development and was later

formerly adopted worldwide. The pursuit of sustainable development projects an attitude and ambition for change and development of a society that genuinely merits the definition of a shift of paradigm. Sustainable development places more emphasis on the social and economic goals of the society, particularly in developing countries, but the attainment of these is linked intimately with the achievement of environmental goals. Hussin, Rahman and Memon (2013) suggested that environmental burdens caused by construction can be minimised and construction technology can be used to remedy the environment. Sustainability in building construction is the response of the building sector to the challenges of sustainable development as depicted in Figure 2.1.

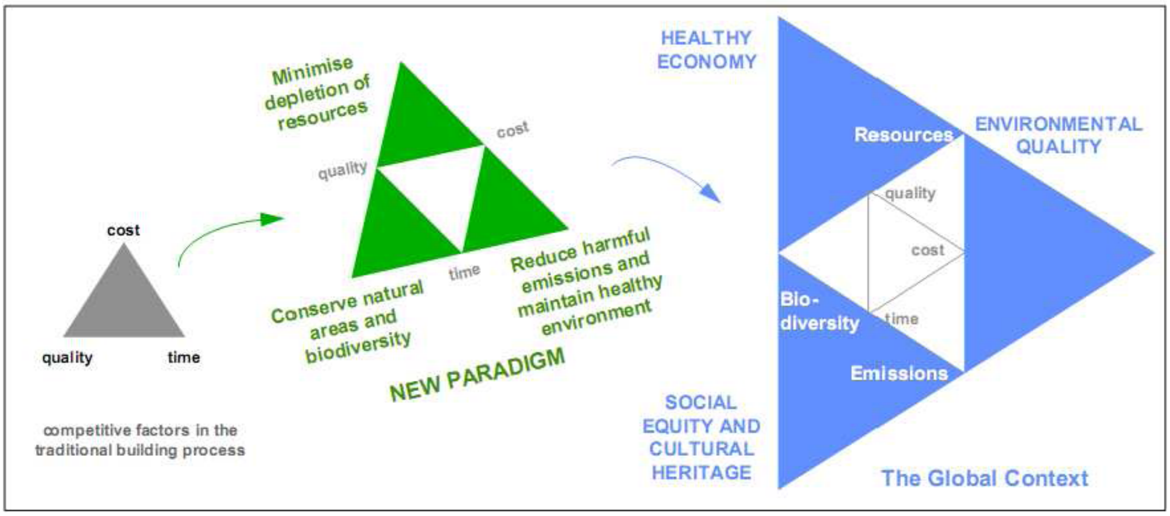

Figure 2.1: Sustainability in construction in a global context

Source: Huovila and Koskela, (1998)

2.3 Sustainability in Construction

Sustainability in construction is used to describe the application of sustainable development in the construction industry (Al-Yami and Price, 2006). According to Dania, Larsen and Yao (2013) the term "sustainability in construction" has sparked numerous interpretations, debates and approaches in academic circles. While Huovila and Koskela (1998) suggested that the concept of sustainability in construction is not clearly defined,

Olonade (2015) saw sustainability in construction as the responsible supply, operation, and maintenance of buildings (or any other infrastructure) that meets the needs of their owners and users over their lifespan with minimal unfavourable environmental impacts, while encouraging economic, social and cultural progress. Shen, Tam, Tam, and Ji (2010) on their part stated that sustainability in construction practice refers to various methods used in a construction project that involves less harm to the environment, increases the reuse of waste in the production of construction materials, benefits the society, and is profitable to a company. Sustainability in construction is all about following suitable practice in terms of materials, their sources, construction methodologies as well as design philosophy so as to be able to improve performance, decrease the environmental burden of a project, minimise waste and be ecologically friendlier (Abolore, 2012).

2.3.1 Purpose of Sustainability in Construction on Building Projects

Although there are various definitions, the aim of sustainability in construction remains the same. Sustainability in construction is a way for the building industry to move towards achieving sustainable development, taking into account environmental, socio-economic and cultural issues (Shafii, Ali and Othman, 2006). Abolore (2012) opined that the goal of sustainability is to guide the economic and social forces of the earth’s nation to live within the goods and services provided by the ecosystems and naturally occurring sources of energy (solar, geothermal) without reducing the availability of these goods, services and energy sources for future generations. The Nigerian construction sector still relies heavily on traditional construction materials which are not sustainable as wide expanses of the ecosystem are destroyed due to excessive extraction and production of materials used for construction. Analysis of the construction industry’s project delivery process substantiates the need for the industry

to engage with sustainable development (Adetunji, Price, Fleming and Kemp, 2003). A summary of this issues and rationales are given in Table 2.1.

Table 2.1: Principal issues on sustainability in construction

Issues	Rationale
1. Environmentally friendly construction materials	As much as 50% of all materials extracted from the earth's crust are transformed into construction materials and products. These same materials when they enter the waste stream account for 50% of all waste generation prior to recovery.
2. Energy efficiency in buildings	The construction, operation and subsequent demolition of built facilities accounts for about 40% of all energy use and a similar percentage of greenhouse emissions.
3. Construction and demolition waste management	Construction and demolition waste constitutes the largest waste stream by weight. Disposing of these waste materials poses increasing difficulties therefore emphasis needs to be placed on waste minimisation and recycling.
4. Water conservation	The operation of buildings places a strain on raw water reserves while waste water and sewage needs to be treated before being returned to water courses.
5. Health in buildings	The quality of the internal environment of buildings is an essential element to the health of its occupants. Bio-climatic considerations and good ventilation can also reduce or even eliminate the need for air conditioning in the hot season, while reducing the amount of energy for heating in the cold season.

Source: Shafii, Ali and Othman (2006)

The principle of sustainability as shown in Figure 2.2 has three main dimensions: economic, social and environmental (Adetunji, Price, Fleming and Kemp 2003; Al-Yami and Price, 2006; Subramanian, 2007; Abolore 2012; Hussin, Rahman and Memon, 2013).

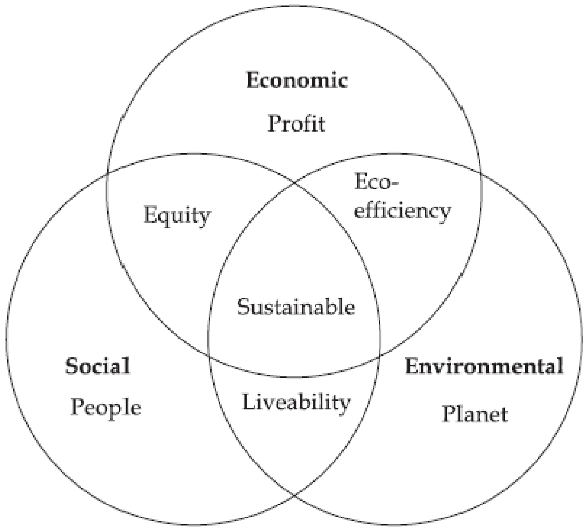

Figure 2.2: Three pillars of sustainability – economic, social and environmental.
Source: Subramanian (2007)

Economic sustainability is the industry's contribution towards maintenance of high and stable levels of economic growth and employment through increased productivity and improved project delivery. Environmental sustainability addresses the impact of construction activities on the environment and propagates the prevention of harmful and potentially irreversible damage to the environment through efficient use of natural resources, waste minimisation, and energy and water efficiency. Social sustainability deals with legal, moral and ethical obligations of the construction industry to its stakeholders such as employees, suppliers and the community in which it operates (Adetunji, Price, Fleming and Kemp, 2003). Shafii, Ali and Othman (2006) observed that the concept of sustainability in building and construction has initially focused on issues of limited resources, especially energy and how to reduce impacts on the natural environment with emphasis on technical issues such as materials, building components, construction technologies and energy related design concepts. Recently, an appreciation of the significance of non-technical issues (soft issues) has grown, giving recognition to economic and social sustainability concerns as well as cultural heritage of the built environment as equally important. Guy and Kibert (1998) reiterated that the tenets of sustainability in construction are;

a. Reduce resource consumption
b. Reuse resources
c. Recycle and use renewable resources
d. Protect nature in all activities
e. minimise or eliminate toxins
f. Use full-cost accounting
g. Create environmental quality

Hussin, Rahman and Memon (2013) stated that “traditional design and construction focuses on cost, performance and quality objectives but sustainable design and construction adds minimisation of resource depletion, minimisation of environmental degradation, and creating a healthy built environment to these criteria”. Thus, the activities of the construction industry must work and comply with the needs to protect and sustain the environment.

2.3.2 Benefits of Sustainability in Building Projects

There are a number of environmental, social and economic benefits to be reaped by contractors, clients, occupants and construction workers from building more sustainably. Based on different studies (Landman, 1999; Al-Yami and Price, 2006; Abolore, 2012), these benefits include:

Improved Health, Comfort, and Productivity/Performance: Abolore (2012) indicated that sustainable building significantly increases occupant’s productivity, increased work place productivity and well-being and will contribute positively to a better quality of life, work efficiency and a healthy working environment.

Lower Construction and Operating Costs: Sustainable behaviour in construction should be pursued not only because it is beneficial for humans, the environment and is required

by environmental legislation, but because it significantly increases financial profit and long-term competitiveness (Abolore, 2012). This is mainly through material reuse and savings on disposal costs because of recycling. For instance, rubble which is an environmental issue can be utilised to fill some deficiencies in building materials; either for building by using the whole blocks, filling or for levelling roads or other applications.

Increased Building Value: Landman (1999) opined that putting environmental features into a building enhances its quality and adds value. Day lighting is a great example of a sustainability practice that delivers environmental, social and economic benefits; not only can natural day-lighting decrease the building's demand for fossil fuel-derived energy for lighting and heating, but it can simultaneously lower energy costs, improve the health and well-being of occupants (thereby lowering labour costs). Additionally, better use of building resources, along with longer useful life-span (Abolore, 2012) using reusable, renewable, recyclable and reparable resources; and using water and energy more efficiently (Al-Yami and Price, 2006) are among the benefits of sustainability in construction as depicted in Figure 2.3.

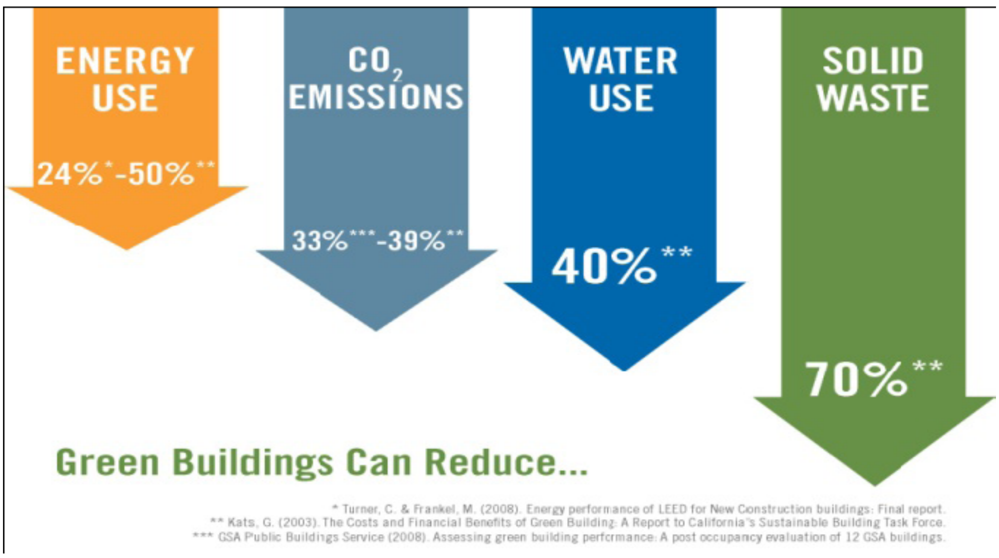

Figure 2.3: Benefits of Green Building
Source: Hussin, Rahman and Memon (2013)

2.4 Level of Awareness of Sustainability Practices

Sustainability creation and awareness depends on understanding the consequences of individual actions, quest for knowledge and absolute involvement and commitment to the principle (Abolore, 2012). Increasing calls for more sustainability in construction have occasioned more actions towards sustainability (Okoye and Okolie, 2013). Dania, Larson and Yao (2013) indicated that there is a dearth of literature relating to sustainability in construction in developing countries, as such there is little evidence, particularly in Africa that the sustainability agenda has moved forward. In Nigeria, the Government indicated its commitment by convening several awareness campaigns and conferences. Recently, the Green Building Council of Nigeria was conceived and professional bodies allied to the sector are taking keen interest, but the effects of these efforts remains to be established (Dania, Larsen and Yao, 2013).

Abolore (2012) conducted a comparative study of environmental sustainability in building construction in Nigeria and Malaysia using quantitative and qualitative techniques and revealed that in a developing country like Nigeria, there is a low level of sustainability in construction due to lack of understanding, awareness and individual commitment to construct sustainably, and no bye-law or regulation by the government to enforce sustainability. This was reiterated by Dania, Larson and Yao (2013) who opined that this is of severe consequence especially in Nigeria where the understanding and awareness of sustainability issues amongst practicing professionals was found to be deficient. Sustainability in construction as an aspect of sustainable development has not received sufficient attention in Nigeria. Ochieng, Wynn, Zuofa, Ruan, Price and Okafor (2014) observed that low level of awareness and understanding about sustainability issues not only exists on people working in public client organisations, but also among the stakeholders organisations and groups such as contractors and end

users. This problem might be attributed to the lack of training on sustainability issues by several institutions and professional bodies. Even though few researchers (Abolore, 2012; Dania, Larsen and Yao; 2013; Ochieng *et al.* 2014) argued that it is crucial to understand the concept of sustainability, there is little or no research on the awareness of sustainability by building professionals in Akwa Ibom State. As such, there was a need to examine the level of awareness of sustainability practices by building professionals in the State.

2.5 Level of Implementation of Sustainability Practices

The quest for sustainable development calls for far reaching changes in the way construction is carried out to reduce damaging consequences of construction activities such as pollution, environmental degradation and natural resources consumption on the built environment (Dania, Larson and Yao, 2013). In pursuing sustainability in construction practice, a great deal of research has been done by many various authors (Huovila and Koskela, 1998; Abolore, 2012; Dania, Larson and Yao, 2013; Ochieng *et al.*, 2014). The concept of sustainability and its practical implementation have been increasingly considered by policy makers to be one of the most critical tools of achieving the right balance between economic, social and environmental objectives (Abolore, 2012). According to Ochieng *et al.* (2014) the promotion of sustainability in practice is by achieving the right balance between these sustainability principles; social, economic and environment in implementing construction projects. Thus, construction clients are increasingly requiring business consultants, contractors and suppliers to adopt sustainability policies in construction process. Huovila and Koskela (1998) cited selected examples of different countries implementing sustainability in construction projects to include; National package for sustainable building in the Netherlands, and Ecological criteria for experimental construction in Finland. Ochieng *et al.* (2014) carried

out a study in the United Kingdom and proved that the integration of sustainability principles into construction projects is significant to manage the current environmental issue and attain significant improvements in performance and improve project delivery. In Nigeria, Abolore (2012) revealed that the level of implementation is very poor due to lack of education and experience, as the concept of sustainability practices has not been widely applied in many projects. The author further observed that when sustainability practices are put in place, construction buildings are healthier for the environment and for people. Therefore, the following section discussed sustainability practices that can be used to engage in building projects resulting in improved building performance, resource efficiency and environmental conservation.

2.5.1 Sustainability Practices during Construction Phase of Building Projects

Sustainability performance of an individual construction project across its life cycle is an indispensable aspect in attaining the goal of sustainable development (Shen, Hao, Tam and Yao, 2007). However, according to Ugwu, Kumaraswamy, Wong and Ng (2006) the process of translating strategic sustainability objectives into concrete action at project-specific level is a difficult task. Shen, Hao, Tam and Yao (2007) separated the process of a project life cycle into inception, design, construction, operation and demolition. The construction stage is to transfer the project design plans into reality. This process involves utilising various types of resources including human resources, equipment, materials and financial resources. The authors observed that activities during the construction stage (pre-construction and construction execution) have close association with environmental impacts such as waste generation and pollution. This study focused on sustainability practices during the construction phase of building projects. In line with this, Lafarge (2015) identified sustainability in construction practices to include: reducing the negative impact of building sites (noise, dust); using

renewable materials in construction to preserve natural resources; improving the thermal inertia of buildings to reduce heating and air-conditioning costs and CO_2 emissions; recycling materials and structures after demolition. Similarly, Abolore (2012) indicated that choosing the right materials which are recyclable after their useful lives, choosing the right methods of construction in terms of energy and resource efficiency and integrating HVAC (Heating, Ventilating, Air-conditioning) systems are means by which sustainability in construction projects can be achieved. Thivaharan (2015) identified five criteria for the implementation of sustainability practice during building construction based on Table 2.2 to include; reduce/recycle/reuse of construction materials, environmental protection, energy efficiency, water efficiency and indoor environmental quality. The author indicated that responsible contractors are also implementing sustainable site planning and innovation in their agenda to follow sustainability practices and protect the environment from pollution.

Table 2.2: Sustainability practice during construction project phase

Sustainability practice during project construction stage	Monitoring procedures during construction
1. Reduce, recycle, reuse of construction materials.	Waste disposal, proper demolition to maximize recover of concrete waste for beneficial reuse and office waste recycling.
2. Environmental protection; New technology and systems	Formwork systems to reduce the use of timber, platform systems to reduce use of scaffolding, use of alternative methods to reduce masonry works.
3. Energy efficiency	Use of alternative solar energy for site office, use of AC power supply instead of generator on project sites.
4. Water efficiency	Equipment to treat and recycle water for non-construction use, environmental friendly

	pesticides and cleaning products on project sites.
5. Indoor environmental quality	Control over dust generation from material storage and vehicles, air quality on site, proper noise management system to reduce noise pollution.

Source: Thivaharan (2015)

According to Presley and Meade (2010), sustainability indicators at project level include, economic: project cost, profitability and client satisfaction; environmental: sustainable site, water efficiency, reduction of waste, indoor environmental quality, impact on community; and social: stakeholder participation. Ugwu, Kumaraswamy, Wong and Ng (2006) identified sustainability practices by contractors to include, environmental: waste management for solid excavated materials and construction materials, water reuse; economic: life cycle cost, employment of labour. Similarly, Shen, Wu and Zhang (2011) provided a list of indicators for project sustainability. On the economic aspect, life cycle cost/benefit/profit, financial risks were among the indicators. The social aspect considers provision of employment opportunities, promotion of community development and public safety. Environmental indicators include, effect on land pollution, air and water quality, noise effect, waste generation and energy savings. Practical examples of sustainability practices successfully implemented by building contractors in Singapore as provided by (Thivaharan, 2015) are as follows:

i. Use of noise barriers at sites;
ii. Wide usage of recycled materials on site for various construction activities;
iii. Extensive use of enhanced hoardings and noise barriers to reduce noise pollution;
iv. Use of vertical green wall at the site office to cool the office and improve aesthetics;
v. Adoption of top-down construction method to enhance productivity and mitigate

impact of noise generated in conventional bottom-up construction.

A Summary of the variables of sustainability practices are presented in Table 2.3.

Table 2.3: Summary of sustainability practices during building construction phase

Sustainability practices	Sources
Environmental Sustainability: Waste management for solid excavated materials and construction materials, water reuse; Sustainable site, water efficiency, reduction of waste, indoor environmental quality, impact on community; Effect on land pollution, air and water quality, noise effect, waste generation and energy savings; Choosing the right recyclable materials after their useful life, choosing the right construction method for resource and energy efficiency, integrating HVAC systems; Increase material efficiency, reduce material intensity via substitution technology, enhance material recyclability, control the use and dispersion of toxic materials, consider the impact of project on air, soil and water; Reducing the negative impacts of building sites (noise and dust), using renewable materials, recycling materials after demolition; Reduce, recycle, reuse of construction materials; Environmental protection (new technology and systems); Energy and water efficiency; Indoor environmental quality.	Ugwu, Kumaraswamy, Wong and Ng (2006); Presley and Meade (2010); Shen, Wu and Zhang (2011); Abolore (2012); Hussin, Rahman and Memon (2013); Lafarge (2015); Thivaharan (2015).
Economic Sustainability: Consider life cycle cost benefit/profit, employment of labour; Profitability and client satisfaction; Develop economic instrument to promote sustainable consumption, consider the economic impact on local structures.	Ugwu, Kumaraswamy, Wong and Ng (2006); Presley and Meade (2010); Hussin, Rahman and Memon (2013).
Social Sustainability: Stakeholder’s participation; Provision of employment opportunities, promotion of community development and public safety; Enhance a participatory approach by involving stakeholders, promote public participation, assess the impact on health and the quality of life.	Presley and Meade (2010); Shen, Wu and Zhang (2011); Hussin, Rahman and Memon (2013).

2.6 Drivers for Implementing Sustainability Practices during Construction

In recent years, few drivers for implementing sustainability practices have been identified by researchers in various countries. The following sub-section presented the review.

2.6.1 Regulatory Framework

Shafii, Ali and Othman (2006) observed that regulatory framework, technologies and tools, commitment by professionals and stakeholders, education and training are needed as drivers for sustainability in construction. Landman (1999) stated that regulatory and non-regulatory sustainable building initiatives, education programs, economic incentives and public-private collaborative efforts are drivers of sustainable building. The author further observed that regulatory (requiring and prohibiting certain actions) or non-regulatory (creating incentives for or simply encouraging and facilitating certain actions) strategies should be used more extensive, but without the simultaneous use of educational and economic strategies, they would likely be resented by many building professionals and will not enjoy a high rate of compliance.

Abolore (2012) suggested that education and training by academicians, and the Nigerian Government's role in encouraging sustainability through their support and incentives will prompt interest among construction players. Ochieng *et al.* (2014) observed that fines and penalties for non-compliance to regulations will lead to more cautious attitude to environmental compliance. On this, Shen, Tam, Tam and Ji (2010) opined that stricter environmental policies are needed as drivers. Supporting this view, Hakkinen and Belloni (2011) observed that sustainability can also be promoted at least to a certain extent with the help of regulations.

2.6.2 Ethics and Behavioural Change

Ochieng *et al.* (2014) identified ethics and behavioural change; legislation and regulation as the major drivers for sustainability in construction. The authors also advocated the active involvement of the end-users, knowledge and information sharing by companies and building authorities, development of powerful methods for sustainability requirement and the use of economic incentives – such as public benefit charges and efforts to increase public awareness as drivers for sustainability in building. Adetunji, Price, Fleming and Kemp (2003) revealed that drivers for change are coming from a wide range of sources including: Government regulations; stakeholder's expectations; increased realisation of the importance of construction image; branding and reputation; and new client procurement policies.

Shafii, Ali and Othman (2006) opined that total and ardent commitment by all players in the construction sectors including the government and the public at large are required in order to achieve sustainability in construction. Thivaharan (2015) revealed that Government regulations and policies; cost reduction and value added benefits; enhanced reputation and increase competiveness of organisations; Government initiatives and incentives; and evidence of environmental damage are the driving force of sustainability practices. Additionally, project owners are major drivers of sustainability (Ochieng *et al.* 2014) and at the project level, owners' commitment to sustainability and introducing green objectives early has a strong relationship with the delivery of green building projects (Yates, 2014).

A summary of the drivers of implementing sustainability practices is shown in Table 2.4

Table 2.4: Summary of the drivers for implementing sustainability practices

Drivers	Source
1. Government and regulation, legislation; financial incentives	Landman (1999); Adetunji, Price, Fleming and Kemp (2003); Abolore (2012); Ochieng *et al.* (2014); Thivaharan (2015).
2. Branding and enhanced reputation, stakeholder's expectations; increased competiveness	Adetunji, Price, Fleming and Kemp (2003); Ochieng *et al.* (2014); Thivaharan (2015).
3. Development of technologies and tools, integrated approach.	Landman (1999), Shafii, Ali and Othman (2006).
4. Client awareness and demand; knowledge and information, innovation; education and training; behavioural change.	Hakkinen and Belloni (2011); Abolore (2012); Ochieng *et al.* (2014).
5. Cost reduction, value added benefits, evidence of environmental damage; operational efficiency.	Landman (1999); Adetunji, Price, Fleming and Kemp (2003); Thivaharan (2015)
6. Owners' commitment to sustainability, introducing green objectives early	Ochieng *et al.* (2014); Yates (2014)

2.7 Barriers of Implementing Sustainability Practices during Construction

Available literatures have identified a number of barriers to the implementation of sustainability practices during building construction (Landman, 1999; Shafii, Ali and Othman, 2006; Pitt, Tucker, Riley and Longden, 2009; Hakkinen and Belloni, 2011; Tan,

Shen and Yao, 2011; Abolore, 2012; Ochieng *et al.* 2014; Thivaharan, 2015). Hakkinen and Belloni (2011) established four barriers of sustainability in building construction to include: Steering mechanisms; economics; client understanding; process and underpinning knowledge. Landman (1999) carried out a qualitative analysis to understand three major barriers to sustainability practices and revealed that: lack of expressed interest from clients; lack of training/education in sustainable design/construction; and higher cost of sustainable building options were responsible. Similar study was reported by Ochieng *et al.* (2014) with a total of five variables: Finance to address sustainability; lack of considerations from client and stakeholders; insufficient knowledge and skills about sustainability; insufficient regulations by government; and resistance to change were identified as potential barriers of sustainability in construction.

Shafii, Ali and Othman (2006) showed that the following variables contributed to barriers for sustainability in construction: lack of awareness on sustainability; lack of training and education in sustainable design and construction; the higher cost of sustainable design option; procurement issues; regulatory barriers; and lack of professional capabilities/designers. Abolore (2012) revealed that: lack of understanding, awareness and commitment; lack of educational/institutional framework; no bye-law or regulation by the Nigerian government to enforce sustainability concept were among the hindrances to sustainability in building construction. Similarly, Tan, Shen and Yao (2011) established in their work that increase in cost, time consuming activities, and resource consumption are the three main factors that discourages contractors from engaging actively in improving their sustainability performance. Pitt, Tucker, Riley and Longden (2009) conducted a statistical analysis and identified affordability, lack of client demand, lack of client awareness and building regulations as major barriers to

sustainability in building construction. Thivaharan (2015) identified increased cost and not economically viable, nature of the industry, lack stakeholder's demand, resistance to change, and addition of risks to a project as the main challenges of implementing sustainability practices during construction.

2.7.1 Steering Mechanisms

Different kinds of instruments are used for steering. According to Hakkinen and Belloni (2011), these include normative regulatory instruments such as building codes, informative regulatory instruments such as mandatory labelling, fiscal instruments and incentives. The lack of steering or the wrong type of steering may hinder sustainability in building construction. On the other hand, sustainability in building can be promoted at least to a certain extent with the help of regulations. Abolore (2012) argued that there is no by-law or regulation by the government to enforce the concept of sustainability due to a lack of Government intervention which may be in the area of not promoting sustainability in construction through appropriate policies and incentives.

Contrary to this, Ochieng *et al.* (2014) argued that there are many regulations and government policies in place to support sustainability issues, but such regulations, policies, incentives and commitment by leadership may not be sufficient enough to move towards the realisation of sustainable development. Adetunji, Price, Fleming and Kemp (2003) highlighted regulatory constraints, inconsistent Government policy and lack of fiscal incentives as barriers to sustainability in building construction. Landman (1999) stated that in addition to federal regulations, government should use regulatory strategies including state and local building codes, and local zoning rules to regulate sustainability in building. Hakkinen and Belloni (2011) argued that rigid normative steering mechanisms may also hinder the adoption of sustainable innovations but

agreed that regulations can also be made in terms of required activities (mandatory declarations). Therefore, there is a need for a more mandatory role in order to better address sustainability.

2.7.2 Cost

The fear of higher investment costs for sustainability in construction project compared with traditional building projects and the risks of unforeseen costs are often addressed as barriers to its implementation. The adoption of sustainability solutions may be hindered because clients are concerned about the higher risk based on unfamiliar techniques, the lack of previous experience and a lack of performance information (Hakkinen and Belloni, 2011). Higher cost may also come from the increases in the consultant’s fees and indirectly from the unfamiliarity of the design team and contractors with sustainability methods. According to Shafii, Ali and Othman (2006), many stakeholders are of the opinion that the construction industries will not go green unless it saves them money somehow. Financial pressure – extra costs and no incentives and financial constraints coupled with investment in the short term but rewards in the long term, which contradict the short term strategic vision are barriers established by Adetunji, Price, Fleming and Kemp (2003).

Ochieng *et al.* (2014) stated that some clients noted that the cost for providing environmental sustainability in building construction and developments is significantly higher than for standard schemes and most were not convinced that there is a potential demand for such buildings. These barriers can be overcome by changing the view of stakeholders from cost (Isang, 2011) to value and from short-term to long- term. On the other hand, Landman (1999) observed that the actual cost of sustainable projects often are not as high as many people think they would be. For instance, by not using “life cycle

costing" or "cost benefit analysis" approach, clients and building professionals are unable to appreciate the cost effectiveness of many sustainability strategies. Lifecycle costing takes into account the gradual savings in operating and maintenance costs, avoided first costs (such as needing to install air conditioning system because of shading or other natural cooling techniques), and avoided economic costs (such as reduced labour or health costs). This observation was supported by Abolore (2012) who asserted that sustainability in building construction costs lower than conventional buildings and saves energy. Thus, building professionals should be educated to correct the misconceptions about the cost of sustainability practices.

2.7.3 Lack of Client Understanding

The demand and willingness of the client eventually determines the development of sustainable project. A building project cannot be done along sustainability lines without the owner or developer's full support for sustainability concepts. Ochieng *et al.* (2014) suggested that in most cases clients lacked the information they need to make choices about which development would be more or less sustainable. In her work, Landman (1999) revealed that lack of interest from clients is the most significant barrier to widespread sustainability in building practice. The author remarked that this may be due to lack of education or "awareness" about sustainable building and economic/financial concerns. Even where building professionals are taking the initiative in promoting sustainability in building, public disinterest is getting in the way. Lack of understanding, vagueness and fussiness of the concept, according to Adetunji, Price, Fleming and Kemp (2003) make its practical application difficult. Abolore (2012) established in his study that the lack of a single agreed-upon definition of sustainability and its objectives has become a real blockage in understanding and implementing sustainability initiatives. Similar observation was made by Dania, Larsen and Yao (2013) that the concept has

been beset by problems concerning a cohesive understanding. Landman (1999) indicated that members of the core project teams often do not have technical understanding of sustainability methods and this serves as a barrier.

2.7.4 Underpinning Knowledge

The following barriers of sustainability are discussed under this sub-section;

Lack of Knowledge and Common Language: Sustainability can be hindered by ignorance or a lack of common understanding. Shafii, Ali and Othman (2006) observed that many stakeholders are not even aware of the concept of sustainability in construction and are naturally resistant to change; hence the greatest barrier is the lack of understanding of the need for sustainability in design. Abolore (2012) stated that one reason for this difficulty is that the philosophical underpinning of sustainability may not be well understood by the population. The author further revealed that most individuals/companies do not promote this concept within their organisation due to the low knowledge of the concept. If individuals within the construction industry are to work to attain environmentally responsible construction, then all practitioners must make a commitment, change their existing behaviour and start adopting new products, ideas and practices.

Availability of Methods and Tools: The efficient use of all necessary information and the effective cooperation of all actors call for methods that enable the management and sharing of information. According to Hakinen and Belloni (2011) tools are needed that support understanding about the value risks, remaining service life, needed maintenance an optimal scheduling of life cycle operations of building. Environmental matters needs to be considered in an early stage of design because alterations to the brief may be expensive. Sustainability should be pursued with the help of an integrated approach. Numerous advanced technological methods to improve sustainability such

as, lean techniques, industrialised building system, building information modelling, value engineering, and sustainable supply chain management (Hussin, Rahman and Memon, 2013), life-cycle assessment tools, energy consumption estimation methods, and service life prediction method (Hakkinen and Belloni, 2011) have been developed. Ochieng *et al.* (2014) observed that although there are assessment tools and indicators already in place, the question is on clarity and when to use them and by whom, is creating confusion and burden among practitioners. The authors further advocated the need to develop simple but wide ranging tools and techniques to deal with situations where sustainability needs to be assessed. Addressing these problems will require significant and sustained investment in education and training alongside increased publicity.

Innovation: Hakkinen and Belloni (2011) suggested different strategies to pursue (either with the help of reducing consumption, improving efficiency or developing substitute and less harmful solutions), but in all cases, the authors observed that innovations are needed. That is why the construction sector should without delay develop its processes and products towards sustainable direction, and to create innovative technologies to remedy the built environment. A summary of the barriers of implementing sustainability practices is presented in Table 2.5.

Table 2.5: Summary of the barriers of implementing sustainability practices

Barriers	Sources
1. Steering mechanism; Lack of regulation to enforce sustainability.	Shafii, Ali and Othman (2006); Pitt, Tucker, Riley and Longden (2009); Hakkinen and Belloni (2011); Tan, Shen and Yao (2011); Abolore (2012).
2. Higher cost of sustainable building construction; Finance to address sustainability; Affordability; Increased cost and not economically viable.	Landman (1999); Shafii, Ali and Othman (2006); Pitt, Tucker, Riley and Longden (2009); Hakkinen and Belloni (2011); Abolore (2012); Ochieng *et al.* (2014); Thivaharan (2015).
3. Lack of interest from clients, lack of training and education; Lack of understanding, awareness and commitment; Lack of consideration from client and stakeholders, insufficient knowledge and skill, resistance to change.	Landman (1999); Shafii, Ali and Othman (2006); Abolore (2012); Hakkinen and Belloni (2011); Ochieng *et al.* (2014); Thivaharan (2015).
4. Procurement issues, lack of professional capabilities.	Shafii, Ali and Othman (2006)
5. Time consuming activities, resource consumption.	Tan, Shen and Yao (2011).
6. Nature of the industry, and addition of risks to projects.	Thivaharan (2015)

2.8 Measures of Improving Sustainability Practices

Relevant literature identified education and training, government incentives, knowledge and awareness (Landman, 1999; Shafii, Ali and Othman, 2006; Abolore, 2012), the development, adoption and mobilisation of sustainable building methods, tools, concepts, and the designers' competence with team work (Hakkinen and Belloni, 2011), regulations and change (Ochieng *et al*. 2014) as measures of improving sustainability practices. Abolore (2012) highlighted the actions that should be taken by academicians to improve sustainability as: educating construction players and stakeholders through collaborative and consultation works; support and incentives of the Government to prompt interest and encouraging civic awareness among people to build sustainably. The authors further advocated the use of conferences, seminars, training and workshops as a means of creating environmental awareness and civic consciousness among the people to build sustainably in the future.

Similar observation was made by Shafii, Ali and Othman (2006) that the industry will have to adapt to this new way of construction by: education and training; planning and construction initiatives through regulations, standards and incentives; adoption of integrated design approach; and development of tools to help in decision making. Ochieng *et al*. (2014) identified incentives and strategies, regulations and change as the success criteria to move towards sustainability in building construction. Practitioners tend to use strategies implemented by the government only when incentive or benefit is in place. Hakkinen and Belloni (2011) suggested that the promotion of sustainability should include: development of the awareness of clients about the benefits of sustainability in building construction; the development, adoption and mobilisation of sustainability methods, tools, concepts, services and the designers' competence along with team work. The authors also stressed the role of local building authorities in

providing information which should be included in education and training programs at all levels and the importance of increasing public awareness, knowledge and guidance about sustainability. Landman (1999) opined that conducting life cycle financial analysis of cost and benefits is one of the measures for sustainability in construction projects. The author further argued that educating all segments of the society about the need for sustainable building, and secondarily, training building professionals in sustainability concepts and methods are the most essential ways of encouraging more widespread sustainability in construction. A summary of the measures of improving sustainability practices from the review is shown in Table 2.6

Table 2.6: Summary of the measures of improving sustainability practices

Measures	Sources
1. Education and training programs for professionals.	Landman (1999); Shafii, Ali and Othman (2006); Abolore (2012); Hakkinen and Belloni (2009).
2. Regulations and change.	Shafii, Ali and Othman (2006); Ochieng *et al.* (2014).
3. Economic incentives; Standards and initiatives.	Landman (1999); Shafii, Ali and Othman (2006); Abolore (2012); Ochieng *et al.* (2014).
4. Development of tools and methods; Competence and teamwork of professionals	Shafii, Ali and Othman (2006); Hakkinen and Belloni (2009); Abolore (2012).
5. Life cycle financial analysis of cost and benefits.	Landman (1999)

6.	Client awareness.	Hakkinen and Belloni (2009); Abolore (2012).

2.9 Gaps in Knowledge

While all the above studies, to various extents have helped with a better understanding of the issues associated with the implementation of sustainability practices in building projects, there were some limitations and a need for further improvement.

1. From the literature review, there was clear evidence that while the concept of sustainable construction has become popular in research, only few existing studies focused on the issue of sustainability in Nigeria. This called for more awareness, particularly on the level of implementation, the drivers, barriers and measures of improving sustainability practices during the construction phase of building projects to be carried out on building sites and this research work satisfied that need.

2. Some of these studies were conducted over 10 years ago. As such, there was a need for a more up-to-date assessment of the drivers as well as the barriers of implementing sustainability practices so as to reflect any development in recent years.
3. The perceptions of most of these researchers from the literature review were from authors at various countries outside the shores of Nigeria. Although, professionals share common knowledge on construction projects, they do have diverse opinions and are influenced by conditions in their specific countries. For instance, it was highly unlikely that providing incentives was not on the Government’s agenda as a driver for implementing sustainability practices in Nigeria, but regulations was. Therefore, an Akwa Ibom based study conducted

with building professionals here, determined issues most relevant to sustainability practices in the state.

4. Few of the existing studies on sustainability practices were conducted using either a quantitative or qualitative approach, these was explicitly validated by conducting a current and carefully designed scientific inquiry using a mixed research design to allow the researcher to use different methods to achieve reliability and the objectives of the study.

These were the assessment that this research work seeked to pursue to contribute to the body of knowledge in this area. The observations underlie the rationale for this study. It aimed to assess the level of implementation of sustainability practices during construction phase of building projects by building professionals in Akwa Ibom State with a view to developing measures to improve its implementation on building site for improved performance, resource efficiency and environmental conservation.

2.10 Conceptual Framework for the Study

2.10.1 Concepts Underpinning the Study

Shields and Rangarjan (2013) defined conceptual framework as “the way ideas are organised to achieve a research project’s purpose”. In light of this, the study looked at the concept of sustainability practices in building projects. Brundtland (1987) defined sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This definition was the main concept underpinning this study and the concept of sustainability in construction emanates from this. Abolore (2012) argued that sustainability in construction refers to the actual process that sustainability is achieved. Sustainability in

construction is all about following suitable practice in terms of materials, their sources, construction methodologies as well as design philosophy so as to be able to improve performance, decrease the environmental burden on a project, minimise waste and be ecologically friendlier. On this Kashyap, Khalfan and Zainul-Abidin (2003) observed that all existing definitions of 'sustainability in construction' still admit that even if it were attained, construction operations would continue to have environmental impacts, although at a reduced rate.

2.10.2 Theories Underpinning the Research

Hill and Bowen (1997) singled out four attributes of sustainability: social, economic, biophysical and technical to advance the understanding of the concept of sustainable construction. However, sustainability principle as outlined in this research is based on three pillars – environmental protection, economic prosperity and social well being (Huovila and Koskela, 1998; Shafii, Ali and Othman, 2006; Subramanian, 2007; Presley and Meade, 2010; Okoye and Okolie, 2013). From an environmental perspective, the basic principle of sustainability concerns the effective management of physical resources so that they are conserved for the future (Abolore, 2012). The economic angle is the industry's contribution towards economic growth and employment through increased productivity, while social sustainability deals with ethical obligation of the construction industry to its employees and the community it operates (Adetunji, Price, Fleming and Kemp, 2003). Sustainability in construction cannot be completely achieved without considering the environmental, economic and social aspects as well. While some approaches focus only on the environmental or social or economic dimensions, the theory guiding this study is that all three aspects are treated together.

2.10.3 Theoretical Framework

This study focused on sustainability practices during the construction phase of building

projects to reduce environmental degradation, excessive resource consumption and CO_2 emissions. This justified the need for Building Professionals to not only be conscious of the role of sustainability, but to also implement these practices. As presented in Figure 2.4, this study first examined the level of awareness of sustainability practices and investigated its level of implementation. The drivers and barriers of implementing sustainability practices were determined and investigated respectively, leading to the outcome of developing measures of improving its implementation for improved building performance, resource efficiency and environmental conservation.

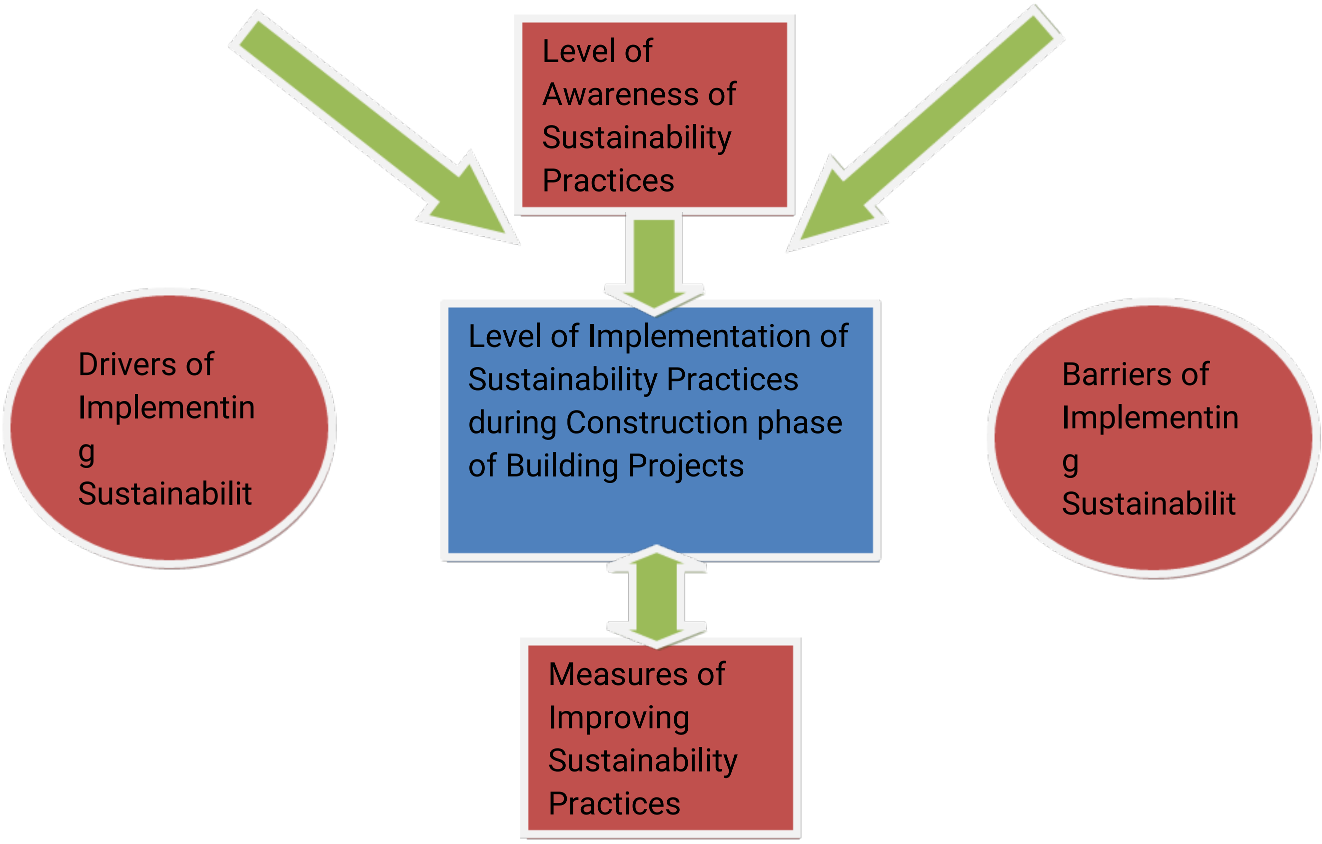

Figure 2.4: Conceptual framework for the study

2.11 Chapter Conclusion

The literature review of this research began with an overview of sustainable development. The global pollution in the areas of soil, water, air, energy, noise, and waste during building construction which necessitated the need for the implementation

of sustainability practices was presented. The concept of sustainability in construction focusing more on it principles, purpose and benefits were discussed. This chapter further provided numerous sustainability practices during the construction phase of building projects and some examples of successfully implemented practices were listed. The drivers and barriers of implementing sustainability practices encountered by building professionals were discussed. The measures of implementing sustainability practices were briefly identified and presented in a tabular form. These were used as a source of information to formulate the questionnaire for this research. This review discovered that what Nigeria needs is the implementation of an environmentally friendly, socially acceptable and economically viable sustainability practices through education and training. Therefore, it was interesting to see the level it was being carried out in Nigeria, particularly the study area. The outcome of this study benefited building professionals who were seeking environmentally friendly construction approach to optimise their resources and improve their performance in building projects. This chapter justified the theoretical background of the study’s objectives and the overall aim of carrying out this research.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Preamble

This chapter discussed the research methodology adopted in this study. It first gave the research design for the study. Following on, the chapter discussed the procedures to data collection and the instruments used. The chapter then provided an overview of the research population and sampling technique. The method of data analysis concluded the chapter.

3.2 Research Design

Research design is the framework that has been created to seek answers to research questions (Naoum, 2007). This study adopted the quantitative and qualitative or mixed research design. This approach was adopted due to the purpose of the study, the type and availability of the information with respect to the research problem. Quantitative data uses structured tools to generate numerical data and uses statistics to interpret, test hypothesis, organise and represent the collected data. This approach was used through a questionnaire survey to collect data from the respondents to test the hypothesis of the study and to examine the level of awareness of sustainability practices, investigate the level of implementation, determine the drivers and barriers, and the measures of improving the implementation of sustainability practices. According to Naoum (2007) qualitative research approach observes people's behaviour, action, knowledge and opinion as an outsider to understand or find out certain variables, factors or questions on the proposed topic. It is usually conducted through interviews to collect subjective data. This approach was used to further gain the opinion and knowledge of building professionals on the level of implementation and the measures of improving the implementation of sustainability practices. This was conducted

through a case study of three public building projects in the study area by interviewing ten purposively selected building professionals consisting of 3 Builders, 2 Architects, 2 Engineers and 3 Quantity Surveyors based on a case study of three building projects they were currently constructing. The mixed approach was chosen to allow different methods to be used to achieve the objectives of the study. This was to increase the validity and ensure the reliability of the study. The research problem and the respondents were considered when selecting this approach. The mixed research approach was applied in Uyo, Ikot Ekpene and Eket senatorial districts to examine the level of awareness of sustainability practices by building professionals and to investigate sustainability practices that are implemented on building sites to reduce the impact of projects on the air, soil and water as well as the measures of improving these practices.

3.3 The Study Area

The study was carried out exclusively in Akwa Ibom State, specifically in Uyo, Ikot Ekpene and Eket, which covered all the three senatorial districts. According to Daniel and Akpan (2006), geographically the state is located at the South Eastern corner of Nigeria between latitudes 4º 30’ and 5º 33’ North and longitudes 7º 30’ and 8º 25’ East. Uyo was chosen to examine the level of awareness of sustainability practices on building projects for building professional to be conscious of these practices. Based on the on-going construction activities by both the public and private sectors which often results in environmental degradation, pollution and carbon emissions which are detrimental to public health, the need arose to investigate if environmentally friendly products, waste management and the impact of construction projects on air, soil and water were considered on building sites in Ikot Ekpene. This justified the need to investigate the level of implementation of sustainability practices and measures of

improving these practices. Furthermore, the processes involved during construction stage of building projects utilises resources and materials. It was thus necessary to investigate if the use of toxic materials are controlled; life cycle costing, recycling and reuse of materials are implemented during building projects for resource efficiency and environmental conservation in Eket and the study area generally.

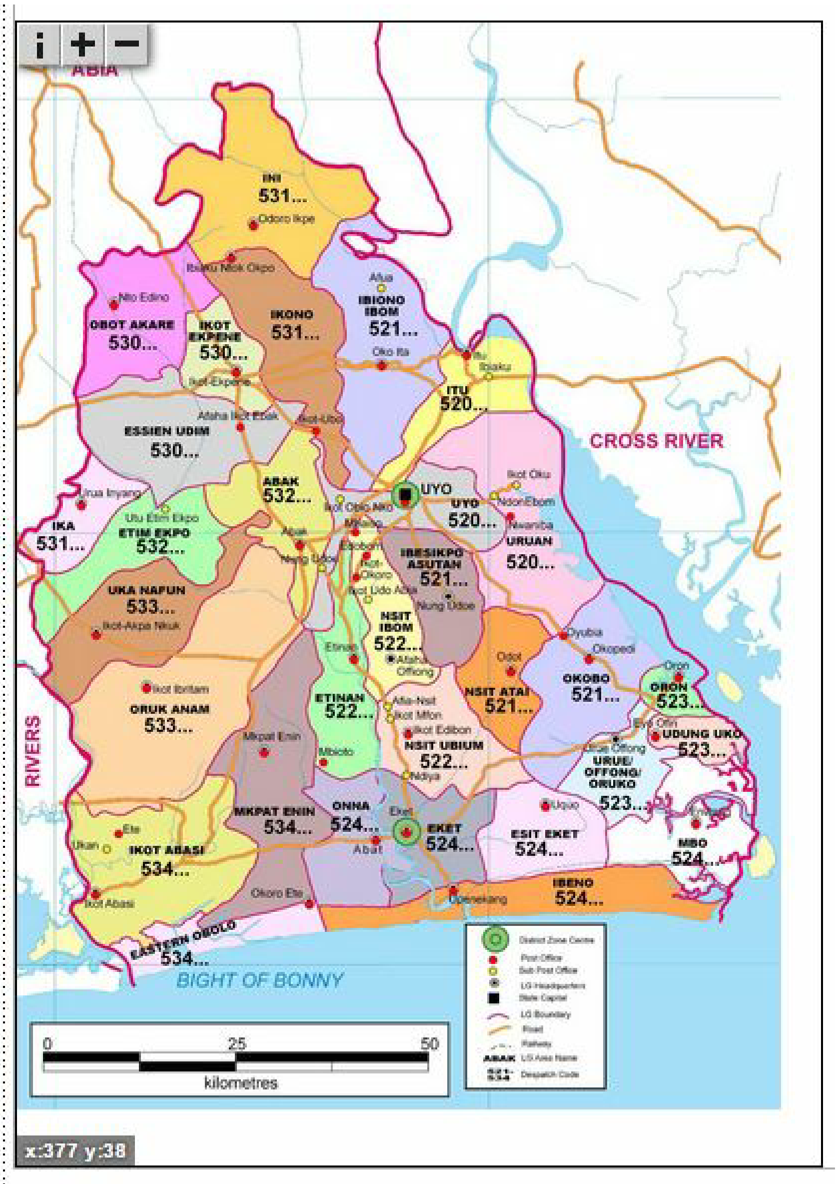

Figure 2.5 Map of Akwa Ibom State showing the study area
Source: Daniel and Akpan (2006)

3.4 Population of the Study

The research population is the totality of all elements (individuals, objects and events) that meet the sample criteria for inclusion in a study. The target population of this study were building professionals (Builders, Architects, Quantity Surveyors and Engineers) who had professional affiliation with the Council of Registered Builders of Nigeria (CORBON), Architects Registration Council of Nigeria (ARCON), Council of Registered Engineers of Nigeria (COREN) and Quantity Surveying Registration Board of Nigeria (QSRBN). The population frame thus consisted of a total of 476 registered Building Professionals operating in Akwa Ibom State which included; 30 Builders, 49 Architects, 350 Engineers (Civil/Structural, Mechanical and Electrical) and 47 Quantity Surveyors operating in Akwa Ibom State. This category of respondents were chosen due to their active involvement in executing building projects and their knowledge of construction activities as they provided valid data to achieve the aim of the study.

3.5 Sample Size

The Taro Yamane formula (Isreal, 2013) was used to derive the sample size;

$$n = \frac{N}{1 + N (e)2}$$

Where n = Sample size

N = Population of the study

e = Level of precision (0.05%)

Table 3.1: Population frame and sample size

Profession	N	n
Architects	49	44
Builders	30	28
Civil/Structural Engineers	149	109
Mechanical Engineers	105	83
Electrical Engineers	95	77
Quantity Surveyors	47	42
Total	476	383

After derivation as depicted in Table 3.1, the sample size for this study comprised 28 Builders, 44 Architects, 109 Civil/Structural Engineers, 83 Mechanical Engineers, 77 Electrical Engineers and 42 Quantity Surveyors making a total of 383. The Taro Yamane formula was chosen due to the large size of the population (Isreal, 2013). To achieve the aim of the study, 17 valid questionnaires were retrieved from Builders, 13 from Architects, 28 from Engineers and 22 from the Quantity Surveyors and used for the analysis.

3.6 Sampling Technique

The stratified random sampling technique was used for the quantitative part of the study. According to Bell (2005), stratified sampling is a method of probability sampling where sub-populations are identified and included in a selected sample in balanced way to minimise selection bias. This sampling technique was adopted to obtain a true representative view from respondents due to the heterogeneous nature of the study population made up of Architects, Builders, Engineers and Quantity Surveyors. For the case study, three public building projects currently executed between 2014 to date was purposively selected and studied by interviewing ten building professionals handling those projects. Purposive sampling technique was used due to the aim of the study and to enable the researcher to select experienced building professionals actively engaged in construction projects to be interviewed.

3.7 Method of Data Collection

The aim and objectives of a research needs to be achieved by data collection. According to Naoum (2007), there are two approaches to data collection namely, primary data collection (fieldwork) and secondary data collection (desk study). Using more than one data collection method strengthens and gives credibility to the study. Multiple sources of data because of the added benefits of validity of the data gathered. The approach for collecting data for this study was divided into two parts; primary and secondary.

3.7.1 Primary Data Sources

The primary data was associated with three practical approaches; the survey approach, the case study approach and the problem solving approach (Naoum, 2007). The survey and case study approaches were used due to the large number of the respondents.

Survey: A survey obtains information from a sample of people by means of self-report, that is, the people respond to a series of questions posed by the investigator. It is used to collect original data for describing a population too large to observe directly. The survey approach was used in collecting information from respondents in the study area by means of a questionnaire.

Questionnaires: A questionnaire is a printed self-report form designed to elicit information that can be obtained through written responses of the subjects. Open-ended and close-ended type of questionnaire was chosen to allow the researcher to get clear answers to the aim and objectives of the research that can be easily analysed using a five-point likert scale. The cross-sectional approach was adopted to enable the respondents to provide data based on the objectives of the study at one point in time for comparing the differences among the subjects (Brady and Johnston, 2008). The

questionnaire was developed by the researcher, refined by 4 senior academicians in order to identify and eliminate mistakes and was self-administered on a one-to-one basis. The questionnaire was carefully designed to be completed by registered building professionals in Akwa Ibom State with extensive knowledge on sustainability issues. The questions were grouped in 5 sections. Section A elicited information on the respondent's characteristics and the nature of projects executed. Section B solicited information on their awareness of sustainability practices. In Section C, the researcher seeked to investigate the level of implementation of sustainability practices with regards to construction operation. Section D determined the drivers and investigated the barriers of implementing sustainability practice, while Section E was designed to solicit the opinion of the respondent on the measures of improving the implementation of sustainability practices in building projects.

Case Study: A case study of three building projects executed in the study area was studied through a structured interview due to the close ended nature of the interview questions. This enabled specific responses from the interviewees on the level of implementation and measures of improving sustainability practices during construction projects to be gathered. The first case study project was an on-going construction of an entrepreneurial centre, ICT complex and a 600 capacity lecture theatre located at the University of Uyo main campus with the consultant being the Fiscal planning unit of the university. The second case study was the remodelling of a new four storey office complex at the Akwa Ibom State civil service secretariat annex by the Akwa Ibom State Government under the Ministry of housing and urban renewal, while the third case study was the construction of an administrative block, new library complex and lecture halls at the Akwa Ibom State College of Education, Afaha Nsit in Ikot Ekpene.

3.7.2 Secondary Data Sources

The secondary sources of information were identified and collected in published journals, articles, books, internet sources and relevant literature materials related to the research problem. This data sources was used in the literature review section of this study to review previous literatures to generate variables for the questionnaire.

3.8 Method of Data Analysis

A variety of methods were used to find answers to the dissertation questions. Aided by the mixed research approach, the study was aimed at assessing the level at which sustainability practices are being implemented during the construction phase of building projects. Descriptive statistical tool; relative importance index was used to analyse the drivers, barriers and measures of implementing sustainability practices. The questions were set for the respondents to rate their level of agreement to each factors using a five-point likert scale of 1 – 5, where 1 represents strongly disagree and 5 represents strongly agree. The RII formula was applied with the weightage of 0 to 1. The RII formula was:

$$\text{Relative Importance Index (RII)} = \frac{\Sigma W}{A \times N}$$

Where; W = Weighting given to each factors by the respondents (5 strongly agree to 1 strongly disagree).

A = The highest weight which is 5 (strongly agree)

N = Total number of respondents

Mean item score was also used in the data analysis to get straight-forward totals for the level of implementation and measures of improving sustainability practices. The formula was given as:

Mean Score (MS) = $\frac{\Sigma\,(f) \quad \times s)}{N}$

Where; f = frequency of response to each rating (5 to 1)

s = The score given to each factor by the respondents (ranging from 5 to 1)

N = The total number of responses concerning that factor.

Test of hypotheses were undertaken using Kruskal Wallis test by comparing the perception of sustainability practices among Builders, Architects, Engineers and Quantity Surveyors in the study area. Kruskal Wallis test was selected due to its ability in comparing two or more independent samples of equal or different sample sizes (Corder and Foreman, 2009). The confidence level of the hypothesis was set at 95% and the decision rule was that if the P-value is less than 0.05, it means the null hypothesis is rejected and the alternative hypothesis is accepted. If otherwise, the null hypothesis is accepted and the alternative hypothesis is rejected. Mann-Whitney U test was also used to conduct a Post-Hoc test on the resulting variables that were significant. The link between the research objectives, the method of data collection and method of data analysis is shown in Table 3.2.

Table 3.2: Link between the research objectives, method of data collection and analysis.

Objectives	Method of data collection	Method of data analysis
Level of awareness of sustainability practices	Survey (Questionnaire)	Average Percentage
Level of implementation of sustainability practices during construction phase of building projects.	Survey (Questionnaire) and Case Study (Interview).	Mean Item Score
Drivers of implementing sustainability practices during construction phase of building projects.	Survey (Questionnaire)	Relative Important Index
Barriers to implementing sustainability practices during construction phase of building projects.	Survey (Questionnaire)	Relative Important Index
Measures of improving the implementation of sustainability practices during construction phase of building projects.	Survey (Questionnaire) and Case Study (Interview).	Mean Item Score and Relative Important Index.

3.9 Chapter Conclusion

In this chapter, the procedure on how the research was conducted from the formulation to conclusion was described in detail. The choice of a mixed research approach, the study area, population of the study, sample size and the sampling technique were justified in this chapter. The chapter concluded by presenting the method of data collection and method of data analysis so as to achieve the objectives of this study.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Preamble

This chapter presented the analysis done and discussed the results in order to fulfil the objectives of the study. The chapter elaborated on the respondent's characteristics, results of analysis regarding the awareness of building professional on sustainability practices, the level of implementation of sustainability practices during building construction, the drivers and barriers were also presented. The last part of this chapter presented the analysis on the measures of improving sustainability practices and the hypotheses of the study which was tested with Kruskal Wallis and Mann-Whitney U test at 0.05 significance level.

4.2 Details of Respondents for the Questionnaire Survey

In section A of the questionnaire, questions pertaining to the personal data of the respondents were obtained. The results were summarised in sections 4.2.1 – 4.2.6.

4.2.1 Professional's Employment Sector

Table 4.1 showed the employment sector of the building professionals. 71.3% were in the public sector while the private sector was 36.3%. This implied that building professionals used in the study were mostly in public building projects.

Table 4.1: Employment sector of the respondents

Sector	Frequency	Percentage
Public *	57	71.3
Private *	29	36.3
Total	86	108

* Respondents ticked more than once, thus the total is more than 80.

4.2.2 Nature of Building Projects Executed

Result from Table 4.2 revealed that 33.8% of residential building projects were executed, followed by commercial projects at 26.5%, while educational projects were 21.3% and industrial projects were 18.4%. This result indicated that majority of building projects executed in the study area were residential in nature.

Table 4.2: Nature of executed building projects

Building Projects	Frequency	Percentage
Educational *	29	21.3
Commercial *	36	26.5
Industrial *	25	18.4
Residential *	46	33.8
Total	136	100

* Respondents ticked more than once, thus the total is more than 80.

4.2.3 Designation of the Respondent

Based on the analysis shown in Table 4.3, Engineers accounted for 35%, followed by Quantity Surveyors 26%, Builders 21.3% and Architects 16.3%. The implication of this result was that built environment professionals were the respondents in the study.

Table 4.3: Designation of respondents

Designation	No. of Respondents	Percentage
Builders	17	21
Architects	13	16
Engineers	28	35
Quantity Surveyors	22	28
Total	80	100

4.2.4 Academic Qualification of the Respondents

The result as shown in Table 4.4 indicates that 52 of the respondents representing 65% hold a B.Sc degree. This is followed by HND and M.Sc with 10 respondents each representing 12.5%. Respondents with a Ph.D and OND were 3 each representing 3.8%. It was clear from this result that majority of the respondents have a B.Sc as maximum qualification. The implication of this was that the respondents have the required

academic qualifications to participate in the study.

Table 4.4: Academic qualification of respondents

Qualification	Frequency	Percentage
OND	3	3.8
HND	10	12.5
B.Sc	52	65.0
M.Sc	10	12.5
Ph.D	3	3.8
PGD	2	2.5
Total	80	100

4.2.5 Professional Affiliation of the Respondents

The result shown in Table 4.5 revealed that 19 of the respondents, representing 23.8%, had professional affiliation with COREN, followed by 14 respondents, representing 17.5%, registered with QSRBN. Respondents affiliated with CORBON and ARCON were 11 each, representing 13.8%. Other respondents included professionals registered with Nigerian Institute of Builders, Nigerian Institute of Architects, Nigerian Institute of Quantity Surveyors, Nigerian Institute of Engineers and Nigerian Institute of Project Managers. This result generally indicated that the data provided by the respondents was reliable due to their professionalism and knowledge about the subject matter.

Table 4.5: Professional affiliation of respondents

Affiliation	Frequency	Percentage
CORBON	11	13.75
ARCON	11	13.75
COREN	19	23.75
QSRBN	14	17.5
Others	25	31.25
Total	80	100

4.2.6 Years of Experience in Executing Building Projects

Table 4.6 showed the years of experience of the respondents in executing building projects in the study area. The result indicated that 55% of the respondents had experience of more than 5 years. This implied that many of the respondents had adequate knowledge and experience in building projects to make useful contribution to

this research.

Table 4.6: Years of work experience of the respondents

Years	Frequency	Percentage
0 – 5	36	45.0
6 – 10	34	42.5
11 – 15	6	7.5
Above 15	4	5.0
Total	80	100

4.3 Details of the Respondents Interviewed

Analysis of the interviews was conducted to get more insight from the respondents on the level of implementation and the measures of improving the implementation of sustainability practices. Table 4.7 revealed that 3 Builders having a combined working experience of 49 years, 2 Architects with 21 working years, 2 Engineers with 17 years of experience and 3 Quantity Surveyors with 28 working years in executing building projects were interviewed. Table 4.7 also showed that 3 of the interviewees had professional affiliation with CORBON and QSRBN, while 2 were affiliated with ARCON and COREN respectively all of which were contractors, consultants and clients in the public and private sectors. This generally implied that the interviewees had adequate qualification, knowledge and experience in executing building projects to make useful inputs to this research.

Table 4.7: Details of the interviewed respondents

S/N	Interviewee's designation	Interviewee's occupation	Duration of the interview	Interview method	Years of experience
Interviewee 1	Builder	Contractor (Public sector)	20	Face to face	17
Interviewee 2	Quantity Surveyor	Consultant (Private sector)	15	Face to face	10
Interviewee 3	Engineer	Consultant (Private sector)	17	Face to face	9
Interviewee 4	Architect	Contractor (Public sector)	22	Face to face	15
Interviewee 5	Quantity Surveyor	Contractor (Public sector)	14	Face to face	7
Interviewee 6	Builder	Contractor (Private sector)	21	Face to face	19
Interviewee 7	Engineer	Contractor (Public sector)	19	Face to face	8
Interviewee 8	Architect	Contractor (Private sector)	15	Face to face	6
Interviewee 9	Quantity Surveyor	Client (Private)	20	Face to face	11
Interviewee 10	Builder	Contractor (Public)	7	Phone	13

4.4. Level of Awareness of Sustainability Practices during Construction Phase of Building Projects

Respondents were asked to indicate their level of awareness on sustainability practices based on 'yes', 'no' and 'not sure'. Indicating 'yes' implied that the respondents was fully aware of sustainability practices while 'no' and 'not sure' implied otherwise. Table 4.8 showed the level of awareness of building professionals on sustainability practices during building projects. The analysis revealed that 66% of the respondents were aware of sustainability practices, while 21% did not have any idea and 13% were not sure of the practices. Furthermore, as shown in Table 4.8, the result also indicated that majority of the building professionals were aware of sustainability practices as the awareness levels calculated for each of the practices were more than 0.5. The average awareness

level for all the respondents was 0.657. This by implication meant that the respondents were aware of major sustainability practices on building construction projects. Only few practices had awareness level less than 0.5 and these were; “provision of equal employment opportunities” with 0.488, “control of carbon emissions” with 0.363 awareness level, “use of noise barriers at site” with 0.35 awareness level and “use of vertical green wall at the site to cool the office” with 0.25 awareness level. It was equally important to look further into the responses based on the professionals handling the building projects. A further analysis was therefore conducted to reveal the responses of each professional that responded to the questionnaire.

In Table 4.9, the average awareness level for the Builder was 0.738, Architect was 0.619. Engineer was 0.664 and the Quantity Surveyors were 0.607. Descriptively, this showed that there were not much variations among the responses. Under all the respondents, regarding the practices with less than 0.5 awareness level as shown in Table 4.8, the result in Table 4.9 revealed that under “provision of equal employment opportunities”, Builders had an awareness level of 0.529, Architects 0.461, Engineers 0.464 and Quantity Surveyors 0.5. Under “control of carbon emissions”, Builders had an awareness level of 0.588, Architects 0.307, Engineers 0.393 and Quantity Surveyors 0.182. For “use of noise barriers at site”, Builders had 0.353, Architects 0.230, Engineers 0.428 and Quantity Surveyors 0.318, while under “use of vertical green wall at the site to cool the office”, Builders had an average awareness level of 0.353, Architects 0.153, Engineers 0.214 and Quantity Surveyors 0.273.

Table 4.8: Level of awareness of sustainability practices

S/N	Sustainability practices	Frequency of response							
		N	Yes		No		Not Sure		AL
			Freq.	%	Freq.	%	Freq.	%	
1	Choosing the right construction method for resource conservation	80	76	95	2	2.5	2	2.5	0.95
2	Consideration of the client's satisfaction	80	76	95	2	2.5	2	2.5	0.95
3	Control of water usage	80	67	84	9	11.3	4	5	0.838
4	Promotion of community development and local source of material	80	65	81.3	9	11.3	6	7.5	0.813
5	Sustainable site planning and innovation	80	63	79	10	13	7	8.8	0.788
6	Use of formwork systems to reduce the use of timber	80	62	78	10	13	8	10	0.775
7	Employment and retention of labour	80	59	74	18	23	3	3.8	0.775
8	Use of life cycle costing in building projects	80	57	71.3	14	18	9	11.3	0.738
9	Control of dust to reduce pollution on building	80	56	70	19	24	5	6.3	0.7
10	Waste management for solid excavated materials	80	54	68	14	18	12	15	0.675
11	Considering the impact of projects on air, soil and water	80	54	68	15	19	11	14	0.675
12	Recycling and reuse of materials	80	54	68	15	19	11	14	0.675
13	Indoor environmental quality	80	52	65	16	20	12	15	0.65
14	Use of renewable materials	80	52	65	16	20	12	15	0.65
15	Controlling the use and dispersion of toxic materials	80	50	63	12	15	18	23	0.625
16	Participatory approach by involving stakeholders	80	49	61.3	14	18	17	23	0.613
17	Use of environmentally friendly cleaning products and pesticides on sites	80	48	60	20	25	12	15	0.6
18	Use of alternative energy sources	80	46	58	22	28	12	15	0.575

	or devices for energy savings								
19	Provision of equal employment opportunities	80	39	49	25	31.3	16	20	0.488
20	Control of carbon emissions	80	29	36.3	38	48	13	16.3	0.363
21	Use of noise barriers at site	80	28	35	39	49	13	16.3	0.35
22	Use of vertical green wall at the site to cool the office	80	20	25	37	46.3	23	29	0.25
	Average awareness level			66		21		13	0.657

N: Frequency; AL: Awareness Level

Table 4.9: Mean of all responses showing the level of awareness of sustainability practices

S/N	Sustainability	Builder			Architect		Engineer		Qty Surveyor
	practices	N	AL	N	AL	N	AL	N	AL
1	Recycling and reuse of materials	17	0.824	13	0.692	28	0.679	22	0.525
2	Control of dust to reduce pollution on building	17	0.765	13	0.307	28	0.857	22	0.682
3	Control of water usage	17	0.882	13	1	28	0.857	22	0.682
4	Control of carbon emissions	17	0.588	13	0.307	28	0.393	22	0.182
5	Use of alternative Energy sources or devices for energy savings	17	0.529	13	0.538	28	0.714	22	0.455
6	Choosing the right construction method for resource conservation	17	1	13	0.846	28	0.929	22	1
7	Use of formwork systems to reduce the use of timber	17	0.824	13	0.692	28	0.857	22	0.682
8	Use of environmen-tally friendly cleaning products and pesticides on site	17	0.705	13	0.692	28	0.607	22	0.455
9	Sustainable site planning and innovation	17	0.824	13	0.923	28	0.714	22	0.773
10	Use of noise barriers at site	17	0.353	13	0.230	28	0.428	22	0.318
11	Use of vertical green wall at the site to cool the office	17	0.353	13	0.153	28	0.214	22	0.273
12	Waste management for solid excavated materials	17	1	13	0.461	28	0.607	22	0.636

13	Indoor environmental quality	17	0.882	13	0.769	28	0.571	22	0.5
14	Controlling the use and dispersion of toxic materials	17	0.765	13	0.385	28	0.75	22	0.5
15	Considering the impact of projects on air, soil and water	17	0.765	13	0.461	28	0.75	22	0.636
16	Use of renewable materials	17	0.824	13	0.846	28	0.5	22	0.590
17	Use of life cycle costing in building projects	17	0.647	13	0.769	28	0.643	22	0.818
18	Consideration of the client's Satisfaction	17	1	13	0.846	28	0.929	22	1
19	Employment and retention of labour	17	0.588	13	0.923	28	0.821	22	0.636
20	Participatory approach by involving stakeholders	17	0.765	13	0.307	28	0.607	22	0.682
21	Provision of equal employment opportunities	17	0.529	13	0.461	28	0.464	22	0.5
22	Promotion of community development and local source of materials	17	0.824	13	1	28	0.714	22	0.818
	Average Awareness level		0.738		0.619		0.664		0.607

N: Frequency; AL: Awareness Level

4.4.1 Test of Hypothesis One on the Level of Awareness of Sustainability Practices among the Professionals

The following hypotheses were postulated to guide the study:

H_0; There is no significant variation in the perception of the level of awareness of sustainability practices during construction phase of building projects among Builders, Engineers, Architects and Quantity Surveyors in the study area.

H_1; There is significant variation in the perception of the level of awareness of sustainability practices during construction phase of building projects among Builders, Engineers, Architects and Quantity Surveyors in the study area.

To test this hypothesis, the confidence level was set at 95%. As such, the decision rule was that if the p-value is less than 0.05, it means the null hypothesis is rejected and the alternative hypothesis is accepted. Otherwise, the null hypothesis is accepted and the alternative hypothesis is rejected. For this particular hypothesis, Kruskal Wallis test was performed in order to ascertain whether or not there was variation in the perception of the Builders, Architects, Engineers and Quantity Surveyors) regarding the level of awareness of sustainability practices in the study area.

The result of this test is shown in Table 4.10. In this result, majority of the variables showed p-values greater than 0.05, which by implication means they are not significant. This meant that the null hypothesis was accepted, while the alternative hypothesis was rejected for them. However, only three variables had p-values less than 0.05. This by implication meant that for those three variables (which were; control of dust to reduce pollution on building with significance level of 0.011, waste management for solid excavated materials with 0.012 and participatory approach by involving stakeholders with 0.036), the null hypothesis was rejected and the alternative hypothesis was accepted. Post-Hoc test was thus conducted for the variables that were significant. The

result shown in Table 4.11 revealed that for control of dust to reduce pollution on building, the perception of the Architect was the source of the variation. For waste management for solid excavated materials, the source of variation was the perception of the Builder while for participatory approach by involving stakeholders, the perception of the Architect was the source of the variation.

Table 4.10: Perception on the level of awareness of sustainability practices among building professionals

Level of awareness	Designation of the respondents	N	Mean rank	Chi square	D/F	Sign.	Remark
Recycling and reuse of materials	Builder	17	33.59	3.476	3	0.324	NS
	Architect	13	42.12				
	Engineer	28	40.45				
	Quantity Surveyor	22	44.95				
Control of dust to reduce pollution on building	Builder	17	37.32	11.181	3	0.011	S
	Architect	13	54.46				
	Engineer	28	34.29				
	Quantity Surveyor	22	42.61				
Control of water usage	Builder	17	38.85	6.558	3	0.087	NS
	Architect	13	34.00				
	Engineer	28	39.66				
	Quantity Surveyor	22	46.68				
Control of carbon	Builder	17	30.29	5.470	3	0.140	NS

emissions	Architect	13	42.12				
	Engineer	28	41.71				
	Quantity Surveyor	22	45.89				
Use of alternative energy sources or devices for energy savings	Builder	17	42.50	2.519	3	0.472	NS
	Architect	13	39.19				
	Engineer	28	36.25				
	Quantity Surveyor	22	45.14				
Choosing the right construction method for resource conservation	Builder	17	38.50	5.382	3	0.146	NS
	Architect	13	44.81				
	Engineer	28	41.29				
	Quantity Surveyor	22	38.50				
Use of formwork systems to reduce the use of timber	Builder	17	38.91	3.061	3	0.382	NS
	Architect	13	45.35				
	Engineer	28	36.96				
	Quantity Surveyor	22	43.36				
Use of environmentally friendly cleaning product and pesticides on site	Builder	17	39.21	1.889	3	0.596	NS
	Architect	13	34.96				
	Engineer	28	40.71				
	Quantity Surveyor	22	44.50				
Sustainable site planning and innovation	Builder	17	38.44	2.357	3	0.502	NS
	Architect	13	35.46				
	Engineer	28	43.34				
	Quantity Surveyor	22	41.45				

Use of noise barriers at site	Builder	17	43.82	0.728	3	0.867	NS
	Architect	13	40.27				
	Engineer	28	38.29				
	Quantity Surveyor	22	40.89				
Use of vertical green wall at the site to cool the office	Builder	17	34.24	3.192	3	0.363	NS
	Architect	13	46.15				
	Engineer	28	43.61				
	Quantity Surveyor	22	38.05				
Waste management for solid excavated materials	Builder	17	27.50	11.036	3	0.012	S
	Architect	13	48.81				
	Engineer	28	43.64				
	Quantity Surveyor	22	41.64				
Indoor environmental quality	Builder	17	31.32	5.968	3	0.113	NS
	Architect	13	37.58				
	Engineer	28	44.07				
	Quantity Surveyor	22	44.77				
Controlling the use and dispersion of toxic materials	Builder	17	33.68	7.424	3	0.060	NS
	Architect	13	50.35				
	Engineer	28	36.46				
	Quantity Surveyor	22	45.09				
Considering the impact of project on air, soil and water	Builder	17	36.38	4.265	3	0.234	NS
	Architect	13	49.08				

	Engineer	28	37.52				
	Quantity Surveyor	22	42.41				
Use of renewable materials	Builder	17	33.32	7.007	3	0.072	NS
	Architect	13	32.81				
	Engineer	28	46.00				
	Quantity Surveyor	22	43.59				
Use of life cycle costing in building projects	Builder	17	42.88	2.684	3	0.443	NS
	Architect	13	38.08				
	Engineer	28	43.73				
	Quantity Surveyor	22	35.98				
Consideration of the client's satisfaction	Builder	17	38.50	5.205	3	0.157	NS
	Architect	13	44.65				
	Engineer	28	41.36				
	Quantity Surveyor	22	38.50				
Employment and retention of labour	Builder	17	47.09	6.191	3	0.103	NS
	Architect	13	33.77				
	Engineer	28	36.88				
	Quantity Surveyor	22	44.00				
Participatory approach by involving stakeholders	Builder	17	35.15	8.566	3	0.036	S
	Architect	13	55.15				
	Engineer	28	39.04				
	Quantity Surveyor	22	37.84				
Provision of equal employment opportunities	Builder	17	39.88	0.730	3	0.866	NS

	Architect	13	37.23				
	Engineer	28	43.00				
	Quantity Surveyor	22	39.73				
Promotion of community development and local source of material	Builder	17	40.41	4.394	3	0.222	NS
	Architect	13	33.00				
	Engineer	28	44.11				
	Quantity Surveyor	22	40.41				

NS: Not Significant; S: Significant; N: Number of Respondents
D/f: Degree of freedom; Sign.: Significant Level

Table 4.11: Post-Hoc test on perception of the level of awareness of sustainability practices among building professionals

Level of awareness	Designation of the respondents	Mean rank	Sign.
Control of dust to reduce pollution on building	Builder	12.53	0.014
	Architect	19.38	
	Builder	24.18	0.481
	Engineer	22.29	
	Builder	18.62	0.399
	Quantity Surveyor	21.07	
	Architect	28.35	0.001
	Engineer	17.59	
	Architect	20.73	0.175
	Quantity Surveyor	16.39	
	Engineer	23.41	0.114
	Quantity Surveyor	28.16	
Waste management for solid excavated materials	Builder	12.00	0.001
	Architect	20.08	
	Builder	17.50	0.004

	Engineer	26.34	
	Builder	16.00	0.006
	Quantity Surveyor	23.09	
	Architect	22.69	0.492
	Engineer	20.21	
	Architect	20.04	0.309
	Quantity Surveyor	16.80	
	Engineer	26.09	0.709
	Quantity Surveyor	24.75	
Participatory approach by involving stakeholders	Builder	12.50	0.001
	Architect	19.42	
	Builder	21.41	0.448
	Engineer	23.96	
	Builder	19.24	0.641
	Quantity Surveyor	20.59	
	Architect	27.12	0.015
	Engineer	18.16	
	Architect	22.62	0.023
	Quantity Surveyor	15.27	
	Engineer	25.91	0.792
	Quantity Surveyor	24.98	

4.5 Level of Implementation of Sustainability Practices during Construction Phase of Building Projects

Table 4.12 showed the mean item score for the level of implementation of sustainability practices for different professionals and all of them combined together. For all of them, the result indicated that consideration of the client's satisfaction was the highest ranked sustainability practices implemented with mean item score (MIS) of 4.39, closely followed by choosing the right construction method for resource conservation ranked 2nd with MIS of 4.21. Provision of equal employment opportunities had a MIS of 3.96 and was ranked 3rd, while promotion of community development and local source of materials with MIS of 3.75 was ranked 4th and control of water usage was ranked 5th with MIS of 3.74. However, the least sustainability practices implemented was revealed to be use of vertical green wall at the site to cool the office with MIS of 2.03, control of carbon emissions with MIS of 2.46, use of noise barriers at site with MIS of 2.48, use of alternative energy sources or devices for energy savings with MIS of 2.75 and control of dust to reduce pollution on building with MIS of 3.05.

Table 4.12: Mean of all responses showing the level of implementation of sustainability practices

Level of implementation	Builder N	Builder MIS	Architect N	Architect MIS	Engineer N	Engineer MIS	Qty Survey. N	Qty Survey. MIS	Overall N	Overall MIS	Rank
Consideration of the client's satisfaction	17	4.06	13	4.62	28	4.54	22	4.32	80	4.39	1st
Choosing the right construction method for resource conservation	17	3.94	13	4.62	28	4.32	22	4.05	80	4.21	2nd
Provision of equal employment opportunities	17	3.71	13	4.85	28	3.96	22	3.64	80	3.96	3rd

Promotion of community deve-lopement and local source of material	17	3.65	13	4.23	28	3.57	22	3.77	80	3.75	4th
Control of water usage	17	3.18	13	4.69	28	3.96	22	3.32	80	3.74	5th
Sustainable site planning and innovation	17	3.65	13	3.15	28	4.43	22	3.18	80	3.71	6th
Considering the impact of project on air, soil and water	17	3.53	13	4.08	28	3.96	22	3.23	80	3.69	7th
Employment and retention of labour	17	3.24	13	4.38	28	3.86	22	3.32	80	3.66	8th
Participatory appro-ach by involving stakeholders	17	3.65	13	3.31	28	3.82	22	3.64	80	3.65	9th
Use of formwork systems to reduce the use of timber	17	2.88	13	3.92	28	3.86	22	3.45	80	3.55	10th
Waste management for solid excavated materials	17	3.53	13	3.69	28	3.89	22	2.95	80	3.53	11th
Use of renewable materials	17	2.88	13	3.85	28	3.61	22	3.18	80	3.38	12th
Use of life cycle costing in	17	1.88	13	3.69	28	3.89	22	3.50	80	3.33	13th

building projects											
Recycling and reuse of materials	17	2.94	13	4.08	28	3.21	22	3.18	80	3.29	14th
Use of environ-mentally friendly cleaning product and pesticide on site	17	2.76	13	4.08	28	3.57	22	2.82	80	3.28	15th
Controlling the use and dispersion of toxic materials	17	2.88	13	3.46	28	3.68	22	2.73	80	3.21	16th
Indoor environ-mental quality	17	3.06	13	3.69	28	3.11	22	2.82	80	3.11	17th
Control of dust to reduce pollution on building	17	2.71	13	2.38	28	3.50	22	3.14	80	3.05	18th
Use of alternative energy sources or devices for energy savings	17	2.18	13	2.46	28	3.25	22	2.73	80	2.75	19th
Use of noise barriers at site	17	1.82	13	2.54	28	2.89	22	2.41	80	2.48	20th
Control of carbon emissions	17	1.94	13	2.77	28	2.71	22	2.36	80	2.46	21st
Use of vertical green wall at the site to cool the office	17	1.65	13	2.08	28	2.39	22	1.82	80	2.03	22nd

N: Frequency; MIS: Mean Item Score

4.5.1 Test of Hypothesis Two on the Level of Implementation of Sustainability Practices among the Professionals

To be able to make a definite statement regarding the variation among building professionals on the level of implementation of sustainability practices, it was necessary to test the following hypothesis:

H_O; There are no significant differences in the perception of the level of implementation of sustainability practices during construction phase of building projects among Builders, Engineers, Architects and Quantity Surveyors in the study area.

H_1; There are significant differences in the perception of the level of implementation of sustainability practices during construction phase of building projects among Builders, Engineers, Architects and Quantity Surveyors in the study area.

To test this hypothesis, the confidence level was set at 95%. As such, the decision rule was that if the p-value is less than 0.05, it means the null hypothesis is rejected and the alternative hypothesis is accepted. Otherwise, the null hypothesis is accepted and the alternative hypothesis is rejected. For this particular hypothesis, Kruskal Wallis test was performed to ascertain whether or not there were differences in the responses of the Builders, Architects, Engineers and Quantity Surveyors regarding the level of implementation of sustainability practices in the study area. The result of the test is shown in Table 4.13. In this result, eleven variables showed p-values greater than 0.05, which implied that they were not significant. This meant that the null hypothesis was accepted, while the alternative hypothesis was rejected for them. However, eleven variables were also with p-values of less than 0.05. This implied that for those eleven variables, the null hypothesis was rejected and the alternative hypothesis was accepted.

Result from the post-hoc test on the perception of the building professionals on the level of implementation of sustainability practices as shown in Table 4.14 revealed that for; control of dust to reduce pollution on building the perception of the Engineer was the source of variation. For control of water usage, the source of the variation came from the perception of the Architect. The source of variation for use of alternative energy sources or devices for energy savings came from the perception of the Builder and Engineer, while for choosing the right construction method for resource conservation was from the Builder and Architect, use of formwork systems to reduce the use of timber came from the perception of the Builder. The perception of the Builder and Architect on the use of environmentally friendly cleaning products and pesticides on sites was the source of the variation and for sustainable site planning and innovation the variation came from the Engineer. For waste management for solid excavated materials, the perception of the Engineer and Quantity Surveyor was the source of the variation, for use of life cycle costing in building projects, the variation came from the Builder, while for employment and retention of labour, the perception of the Builder and Architect was the source of the variation and for provision of equal employment opportunities, the variation came from the perception of the Architect.

Table 4.13: Perception on the level of implementation of sustainability practices among building professionals

Level of implementation	Designation of the respondents	N	Mean rank	Chi square	D/F	Sign.	Remark
Recycling and reuse of materials	Builder	17	34.35	7.059	3	0.070	NS
	Architect	13	55.08				
	Engineer	28	38.70				
	Quantity Surveyor	22	38.93				
Control of dust to reduce pollution on building	Builder	17	34.47	8.787	3	0.032	S
	Architect	13	28.42				
	Engineer	28	48.82				
	Quantity Surveyor	22	41.70				
Control of water usage	Builder	17	30.38	16.584	3	0.001	S
	Architect	13	60.15				
	Engineer	28	43.46				
	Quantity Surveyor	22	32.93				
Control of carbon emissions	Builder	17	33.00	2.766	3	0.429	NS
	Architect	13	44.35				
	Engineer	28	43.41				
	Quantity Surveyor	22	40.32				
Use of alternative energy sources or devices for energy savings	Builder	17	29.21	8.933	3	0.030	S
	Architect	13	35.81				
	Engineer	28	49.21				
	Quantity Surveyor	22	40.91				

Choosing the right construction method for resource conservation	Builder	17	32.06	8.361	3	0.039	S
	Architect	13	51.46				
	Engineer	28	44.71				
	Quantity Surveyor	22	35.18				
Use of formwork systems to reduce the use of timber	Builder	17	25.12	11.666	3	0.009	S
	Architect	13	47.77				
	Engineer	28	46.64				
	Quantity Surveyor	22	40.27				
Use of environmentally friendly cleaning product and pesticides on site	Builder	17	29.91	13.817	3	0.003`	S
	Architect	13	56.38				
	Engineer	28	45.29				
	Quantity Surveyor	22	33.20				
Sustainable site planning and innovation	Builder	17	35.62	16.990	3	0.001	S
	Architect	13	33.85				
	Engineer	28	54.34				
	Quantity Surveyor	22	30.59				
Use of noise barriers at site	Builder	17	30.59	5.091	3	0.165	NS
	Architect	13	41.50				
	Engineer	28	46.16				
	Quantity Surveyor	22	40.36				
Use of vertical green wall at the site to cool the office	Builder	17	34.00	4.072	3	0.254	NS
	Architect	13	41.96				
	Engineer	28	46.41				

	Quantity Surveyor	22	37.14				
Waste management for solid excavated materials	Builder	17	40.06	9.834	3	0.020	S
	Architect	13	43.69				
	Engineer	28	48.50				
	Quantity Surveyor	22	28.77				
Indoor environmental quality	Builder	17	40.00	3.584	3	0.310	NS
	Architect	13	49.96				
	Engineer	28	40.66				
	Quantity Surveyor	22	35.09				
Controlling the use and dispersion of toxic materials	Builder	17	34.88	6.970	3	0.073	NS
	Architect	13	44.15				
	Engineer	28	48.04				
	Quantity Surveyor	22	33.09				
Considering the impact of project on air, soil and water	Builder	17	36.74	6.147	3	0.105	NS
	Architect	13	46.96				
	Engineer	28	46.09				
	Quantity Surveyor	22	32.48				
Use of renewable materials	Builder	17	30.68	7.163	3	0.067	NS
	Architect	13	49.69				
	Engineer	28	44.95				
	Quantity Surveyor	22	37.00				
Use of life cycle costing in building projects	Builder	17	18.91	20.558	3	0.000	S

	Architect	13	45.73				
	Engineer	28	49.30				
	Quantity Surveyor	22	42.89				
Consideration of the client's satisfaction	Builder	17	31.24	6.597	3	0.086	NS
	Architect	13	48.58				
	Engineer	28	44.43				
	Quantity Surveyor	22	37.89				
Employment and retention of labour	Builder	17	31.68	10.990	3	0.012	S
	Architect	13	55.08				
	Engineer	28	44.43				
	Quantity Surveyor	22	33.70				
Participatory approach by involving stakeholders	Builder	17	40.50	3.910	3	0.271	NS
	Architect	13	30.38				
	Engineer	28	44.86				
	Quantity Surveyor	22	40.93				
Provision of equal employment opportunities	Builder	17	33.79	15.438	3	0.001	S
	Architect	13	60.62				
	Engineer	28	41.59				
	Quantity Surveyor	22	32.41				
Promotion of community development and local source of materials	Builder	17	34.97	5.380	3	0.146	NS
	Architect	13	51.62				
	Engineer	28	37.04				
	Quantity Surveyor	22	42.61				

NS: Not Significant; S: Significant; N: Number of Respondents

Table 4.14: Post-Hoc test on perception of the level of implementation of sustainability practices among building professionals

Level of implementation	Designation of the respondents	Mean rank	Sign.
Control of dust to reduce pollution on building	Builder	13.96	0.384
	Architect	16.68	
	Builder	17.68	0.029
	Engineer	26.23	
	Builder	18.12	0.349
	Quantity Surveyor	21.45	
	Architect	13.96	0.009
	Engineer	24.27	
	Architect	14.50	0.110
	Quantity Surveyor	20.07	
	Engineer	27.32	0.305
	Quantity Surveyor	23.18	
Control of water usage	Builder	10.97	0.001
	Architect	21.42	
	Builder	18.06	0.040
	Engineer	26.00	
	Builder	19.35	0.748
	Quantity Surveyor	20.50	
	Architect	27.77	0.008
	Engineer	17.86	
	Architect	24.96	0.001
	Quantity Surveyor	13.89	
	Engineer	28.61	0.077
	Quantity Surveyor	21.55	

Use of alternative energy sources or devices for energy savings	Builder	14.00	0.263
	Architect	17.46	
	Builder	16.41	0.007
	Engineer	27.00	
	Builder	16.79	0.112
	Quantity Surveyor	22.48	
	Architect	16.08	0.065
	Engineer	23.29	
	Architect	16.27	0.433
	Quantity Surveyor	19.02	
	Engineer	27.93	0.172
	Quantity Surveyor	22.41	
Choosing the right construction method for resource conservation	Builder	12.32	0.015
	Architect	19.65	
	Builder	18.56	0.057
	Engineer	25.70	
	Builder	19.18	0.671
	Quantity Surveyor	20.64	
	Architect	23.35	0.331
	Engineer	19.91	
	Architect	22.46	0.032
	Quantity Surveyor	15.36	
	Engineer	28.11	0.125
	Quantity Surveyor	22.18	
Use of formwork systems to reduce the use of timber	Builder	11.24	0.001
	Architect	21.08	

	Builder	15.12	0.001
	Engineer	27.79	
	Builder	16.76	0.092
	Quantity Surveyor	22.50	
	Architect	21.08	0.976
	Engineer	20.96	
	Architect	19.62	0.454
	Quantity Surveyor	17.05	
	Engineer	26.89	0.429
	Quantity Surveyor	23.73	
Use of environmentally friendly cleaning product and pesticides on site	Builder	10.97	0.001
	Architect	21.42	
	Builder	17.65	0.025
	Engineer	26.25	
	Builder	19.29	0.725
	Quantity Surveyor	20.55	
	Architect	24.73	0.156
	Engineer	19.27	
	Architect	19.62	0.004
	Quantity Surveyor	17.05	
	Engineer	28.77	0.065
	Quantity Surveyor	21.34	
Sustainable site planning and innovation	Builder	16.09	0.662
	Architect	14.73	
	Builder	15.41	0.001
	Engineer	27.61	
	Builder	22.12	0.280

	Quantity Surveyor	18.36	
	Architect	14.85	0.015
	Engineer	23.86	
	Architect	18.27	0.903
	Quantity Surveyor	17.84	
	Engineer	31.88	0.000
	Quantity Surveyor	17.39	
Waste management for solid excavated materials	Builder	14.97	0.697
	Architect	16.19	
	Builder	19.85	0.189
	Engineer	24.91	
	Builder	23.24	0.103
	Quantity Surveyor	17.50	
	Architect	19.69	0.615
	Engineer	21.61	
	Architect	21.81	0.081
	Quantity Surveyor	15.75	
	Engineer	30.98	0.002
	Quantity Surveyor	18.52	
Use of life cycle costing in building projects	Builder	10.82	0.001
	Architect	21.62	
	Builder	12.71	0.000

	Engineer	29.25	
	Builder	13.38	0.001
	Quantity Surveyor	25.11	
	Architect	19.54	0.578
	Engineer	21.68	
	Architect	18.58	0.792
	Quantity Surveyor	17.66	
	Engineer	27.38	0.285
	Quantity Surveyor	23.11	
Employment and retention of labour	Builder	11.62	0.004
	Architect	20.58	
	Builder	18.29	0.051
	Engineer	25.86	
	Builder	19.76	0.907
	Quantity Surveyor	20.18	
	Architect	25.00	0.123
	Engineer	19.14	
	Architect	23.50	0.011
	Quantity Surveyor	14.75	
	Engineer	28.43	0.098
	Quantity Surveyor	21.77	
Provision of equal employment opportunities	Builder	11.12	0.001
	Architect	21.23	
	Builder	20.18	0.237
	Engineer	24.71	
	Builder	20.50	0.800
	Quantity Surveyor	19.61	

	Architect	27.81	0.006
	Engineer	17.84	
	Architect	25.58	0.000
	Quantity Surveyor	13.52	
	Engineer	28.04	0.146
	Quantity Surveyor	22.27	

4.5.2 Qualitative Interview on the Implementation of Sustainability Practices in Building Projects

10 Building Professionals consisting of 3 Builders, 2 Architects, 2 Engineers and 3 Quantity Surveyors were purposively selected to participate in an interview based on a case study of 3 building projects they were currently executing. The first question was for the interviewees to shed more light regarding the implementation of sustainability practices during building projects while the second question was meant to provide insight on the measures of improving the implementation of sustainability practices from the interviewees. Based on the first part of the interview, interviewee 1 was of the opinion that sustainability practices are done subconsciously in building projects without knowing it. The opinion of interviewee 2 was that planting trees and grasses on site are part of the sustainability practices implemented on site. Interviewee 3 mentioned that health and safety management/best practice were implemented on his building project. The view of interviewee 4 was that extensive allowance for green areas and trees as opposed to hard stands and pavements should be carried out when executing building projects. While interviewee 5 stressed more on the need to carry out community development project to impact the environment, interviewee 6, 7 and agreed with interviewee 2 and 4 on planting ornamental plant and grass for landscaping purposes. Interviewee 8 was of the opinion that the use of toxic materials should be

reduced during construction and interviewee 10 mentioned the use of steel/panel formwork systems to reduce the use of timber as other sustainability practices implemented on his building project. All of the interviewees acknowledged that sustainability practices are implemented during building projects, though interviewee 1 specifically mentioned that it was done subconsciously.

4.6 Drivers for Implementing Sustainability Practices during Construction Phase of Building Projects

Table 4.15 showed the relative importance index of the drivers for implementing sustainability practices for different building professionals and all of them combined together. For all of them, the result revealed that regulation by the Government is the major driving factor for the implementation of sustainability practices with relative importance index (RII) of 0.906. Client's awareness and knowledge was ranked 2nd with RII of 0.87, knowledge and information sharing by building authorities was ranked 3rd with RII of 0.856, development of technologies and tools for sustainability requirement was ranked 4th with RII of 0.85 and commitment by professionals and stakeholders was ranked 5th with RII of 0.842. On the other hand, introducing green objectives early with overall RII of 0.75, new client procurement policies with RII of 0.752, evidence of environmental damage with RII of 0.756, public – private partnership with RII of 0.758 and ethics and behavioural change with RII of 0.778 were ranked as the least drivers for implementing sustainability practices.

Table 4.15: Mean of all responses showing the drivers for implementing sustainability practices

Drivers for sustainability	Builder		Architect		Engineer		Qty Survy.		Overall		
	N	RII	N	RII	N	RII	N	RII	N	RII	Rank
Regulations by the government	17	0.87	13	0.984	28	0.928	22	0.854	80	0.906	1st
Client's awareness and knowledge	17	0.836	13	0.97	28	0.878	22	0.828	80	0.87	2nd
Knowledge and information sharing by building authorities	17	0.824	13	0.876	28	0.842	22	0.882	80	0.856	3rd
Development of technologies and tools for sustainability requirement	17	0.87	13	0.784	28	0.886	22	0.828	80	0.85	4th
Commitment by professionals and stakeholders	17	0.848	13	0.876	28	0.858	22	0.8	80	0.842	5th
Value added benefits and operational efficiency	17	0.848	13	0.754	28	0.886	22	0.828	80	0.84	6th

Education and training programs by academicians	17	0.812	13	0.876	28	0.9	22	0.754	80	0.838	7th
Branding and enhanced reputation	17	0.742	13	0.984	28	0.822	22	0.82	80	0.83	8th
Cost reduction	17	0.752	13	0.784	28	0.842	22	0.9	80	0.83	8th
Public awareness	17	0.742	13	0.892	28	0.842	22	0.818	80	0.822	9th
Owner's commitment to sustainability	17	0.788	13	0.784	28	0.792	22	0.836	80	0.802	10th
Use of integrated approach	17	0.8	13	0.908	28	0.808	22	0.71	80	0.796	11th
Empowering project team members to develop innovative solutions	17	0.824	13	0.646	28	0.836	22	0.79	80	0.79	12th
Integration of Environmental Management System	17	0.824	13	0.692	28	0.778	22	0.81	80	0.782	13th
Ethics and	17	0.83	13	0.77	28	0.77	22	0.74	80	0.77	14th

behavioural change		6				2		6		8	
Public-private collaborative Partnership	17	0.8	13	0.63	28	0.836	22	0.7	80	0.758	15th
Evidence of environmental Damage	17	0.788	13	0.77	28	0.758	22	0.718	80	0.756	16th
New client procurement policies	17	0.776	13	0.892	28	0.664	22	0.764	80	0.752	17th
Introducing green objectives early	17	0.788	13	0.738	28	0.79	22	0.782	80	0.75	18th

N: Number of Respondents; RII: Relative Importance Index

4.6.1 Test of Hypothesis Three on the Drivers for Sustainability Practices among the Professionals

The following hypotheses were postulated to guide the study:

H_O; There is no significant variation in the perception of the drivers for sustainability practices during construction phase of building projects among Builders, Engineers, Architects and Quantity Surveyors in the study area.

H_1; There is significant variation in the perception of the drivers for sustainability practices during construction phase of building projects among Builders, Engineers, Architects and Quantity Surveyors in the study area.

To test this hypothesis, the confidence level was set at 95%. As such, the decision rule was that if the p-value is less than 0.05, it means the null hypothesis is rejected and the alternative hypothesis is accepted. Otherwise, the null hypothesis is accepted and the alternative hypothesis is rejected. For this particular hypothesis, Kruskal Wallis test was performed in order to ascertain whether or not there is variation in the perception of the Builders, Architects, Engineers and Quantity Surveyors regarding the drivers for sustainability practices in the study area. The result of this test as shown in Table 4.16 revealed that with majority of the variables (eleven) showed p-values greater than 0.05, which by implication meant they were not significant. This meant that the null hypothesis was accepted, while the alternative hypothesis is rejected for them.

However, eight variables were with p-values less than 0.05. This by implication meant that for those eight variables (which were; branding and reputation with significance level of 0.000, use of integrated approach with 0.004, client's awareness and knowledge with 0.024, value added benefits and operational efficiency with 0.043, education and training programs by academicians with 0.032, public – private collaborative partnership with 0.003, empowering project team members to develop innovative solutions with 0.048 and new client procurement policies with 0.008), the null hypothesis was rejected and the alternative hypothesis was accepted. Mann Whitney U test was thus conducted for the variables that were significant. The result shown in Table 4.17 revealed that for branding and reputation, the source of the variation came from the perception of the Architect. For use of integrated approach, the variation came from the perception of the Architect and Quantity Surveyor, while for client's awareness and knowledge the source of variation was attributed to the Architect and for value added benefits and operational efficiency the perception of the Architect and Engineer was the source of the variation. For education and training programs by academicians,

the Builder and Engineer was the source of the variation while the perception of the Builder, Architect, Engineer and Quantity Surveyor on public – private collaborative partnership was the source of the variation. The perception of the Architect on empowering project team members to develop innovative solution contributed to the variation and for new client procurement policies the variation also came from the Architect.

Table 4.16: Perception on the drivers for sustainability practices among building professionals

Drivers for implementation	Designation of the respondents	N	Mean rank	Chi square	D/F	Sign.	Remark
Regulations by the Government	Builder	17	36.91	5.639	3	0.131	NS
	Architect	13	50.73				
	Engineer	28	41.54				
	Quantity Surveyor	22	35.91				
Branding and enhanced reputation	Builder	17	30.85	20.659	3	0.000	S
	Architect	13	63.85				
	Engineer	28	39.02				
	Quantity Surveyor	22	36.05				
Use of integrated approach	Builder	17	41.53	13.296	3	0.004	S
	Architect	13	56.15				
	Engineer	28	41.64				
	Quantity Surveyor	22	29.00				
Development of technologies and tools for sustainability	Builder	17	42.21	3.750	3	0.290	NS
	Architect	13	31.50				

requirement	Engineer	28	44.93				
	Quantity Surveyor	22	38.86				
Client's awareness and knowledge	Builder	17	31.91	9.443	3	0.024	S
	Architect	13	54.96				
	Engineer	28	41.07				
	Quantity Surveyor	22	37.86				
Cost reduction	Builder	17	35.38	6.735	3	0.081	NS
	Architect	13	30.19				
	Engineer	28	42.63				
	Quantity Surveyor	22	47.84				
Empowering project team members to develop innovative solutions	Builder	17	43.82	7.926	3	0.048	S
	Architect	13	25.46				
	Engineer	28	45.45				
	Quantity Surveyor	22	40.52				
Ethics and behavioral change	Builder	17	47.21	2.463	3	0.482	NS
	Architect	13	41.69				
	Engineer	28	38.93				
	Quantity Surveyor	22	36.61				
Integration of Environmental Management System	Builder	17	45.65	4.565	3	0.207	NS
	Architect	13	30.65				
	Engineer	28	39.57				
	Quantity Surveyor	22	43.52				
Public awareness	Builder	17	30.09	5.939	3	0.115	NS
	Architect	13	47.96				

	Engineer	28	41.64				
	Quantity Surveyor	22	42.68				
New client procurement policies	Builder	17	43.21	11.86 7	3	0.008	S
	Architect	13	56.19				
	Engineer	28	30.98				
	Quantity Surveyor	22	41.25				
Knowledge and information sharing by building authorities	Builder	17	36.29	1.277	3	0.735	S
	Architect	13	42.50				
	Engineer	28	39.73				
	Quantity Surveyor	22	43.55				
Owner’s commitment to sustainability	Builder	17	37.24	2.136	3	0.545	NS
	Architect	13	37.50				
	Engineer	28	39.43				
	Quantity Surveyor	22	46.16				
Introducing green objectives early	Builder	17	44.03	1.608	3	0.658	NS
	Architect	13	39.92				
	Engineer	28	36.55				
	Quantity Surveyor	22	43.14				
New client procurement policies	Builder	17	43.21	11.86 7	3	0.008	S
	Architect	13	56.19				
	Engineer	28	30.98				
	Quantity Surveyor	22	41.25				

Knowledge and information sharing by building authorities	Builder	17	36.29	1.277	3	0.735	S
	Architect	13	42.50				
	Engineer	28	39.73				
	Quantity Surveyor	22	43.55				
Owner's commitment to sustainability	Builder	17	37.24	2.136	3	0.545	NS
	Architect	13	37.50				
	Engineer	28	39.43				
	Quantity Surveyor	22	46.16				
Introducing green objectives early	Builder	17	44.03	1.608	3	0.658	NS
	Architect	13	39.92				
	Engineer	28	36.55				
	Quantity Surveyor	22	43.14				
New client procurement policies	Builder	17	43.21	11.867	3	0.008	S
	Architect	13	56.19				
	Engineer	28	30.98				
	Quantity Surveyor	22	41.25				
Knowledge and information sharing by building authorities	Builder	17	36.29	1.277	3	0.735	S
	Architect	13	42.50				
	Engineer	28	39.73				
	Quantity Surveyor	22	43.55				
Owner's commitment to	Builder	17	37.24	2.136	3	0.545	NS

sustainability	Architect	13	37.50				
	Engineer	28	39.43				
	Quantity Surveyor	22	46.16				
Introducing green objectives early	Builder	17	44.03	1.608	3	0.658	NS
	Architect	13	39.92				
	Engineer	28	36.55				
	Quantity Surveyor	22	43.14				

NS: Not Significant; S: Significant; N: Number of Respondents

Table 4.17: Post-Hoc test on perception of the drivers of sustainability practices among building professionals

Drivers for implementation	Designation of the respondents	Mean rank	Sign.
Branding and enhanced reputation	Builder	10.85	0.000
	Architect	21.58	
	Builder	19.94	0.181
	Engineer	24.86	
	Builder	18.06	0.291
	Quantity Surveyor	21.50	
	Architect	30.04	0.000
	Engineer	16.80	
	Architect	26.23	0.000
	Quantity Surveyor	13.14	
	Engineer	26.36	0.575
	Quantity Surveyor	24.41	
Use of integrated approach	Builder	13.00	0.047
	Architect	18.77	
	Builder	22.94	0.980

	Engineer	23.04	
	Builder	23.59	0.054
	Quantity Surveyor	17.23	
	Architect	25.88	0.055
	Engineer	18.73	
	Architect	25.50	0.000
	Quantity Surveyor	13.57	
	Engineer	28.88	0.047
	Quantity Surveyor	21.20	
Client’s awareness and knowledge	Builder	11.47	0.001
	Architect	20.77	
	Builder	19.68	0.135
	Engineer	25.02	
	Builder	18.76	0.517
	Quantity Surveyor	20.95	
	Architect	26.00	0.034
	Engineer	18.68	
	Architect	22.19	0.030
	Quantity Surveyor	15.52	
	Engineer	26.38	0.599
	Quantity Surveyor	24.39	
Value added benefits and operational efficiency	Builder	17.79	0.076
	Architect	12.50	
	Builder	20.68	0.307

	Engineer	24.41	
	Builder	20.15	0.939
	Quantity Surveyor	19.89	
	Architect	13.77	0.004
	Engineer	24.36	
	Architect	14.35	0.079
	Quantity Surveyor	20.16	
	Engineer	27.45	0.599
	Quantity Surveyor	23.02	
Education and training programs by academicians	Builder	13.76	0.179
	Architect	17.77	
	Builder	18.06	0.026
	Engineer	26.00	
	Builder	21.12	0.562
	Quantity Surveyor	19.14	
	Architect	20.46	0.824
	Engineer	21.25	
	Architect	21.54	0.097
	Quantity Surveyor	15.91	
	Engineer	29.75	0.011
	Quantity Surveyor	20.09	
Public-private collaborative partnership	Builder	18.71	0.013
	Architect	11.31	
	Builder	21.41	0.495
	Engineer	23.96	
	Builder	23.62	0.059
	Quantity Surveyor	17.20	

	Architect	13.00	0.002
	Engineer	24.71	
	Architect	15.88	0.315
	Quantity Surveyor	19.25	
	Engineer	30.04	0.009
	Quantity Surveyor	19.73	
Empowering project team members to develop innovative solutions	Builder	18.53	0.025
	Architect	11.54	
	Builder	22.38	0.792
	Engineer	23.38	
	Builder	20.91	0.631
	Quantity Surveyor	19.30	
	Architect	14.15	0.009
	Engineer	24.18	
	Architect	13.77	0.048
	Quantity Surveyor	20.50	
	Engineer	26.89	0.413
	Quantity Surveyor	23.73	

New client procurement policies	Builder	12.85	0.044
	Architect	18.96	
	Builder	27.88	0.039
	Engineer	20.04	
	Builder	20.47	0.810
	Quantity Surveyor	19.64	
	Architect	29.23	0.002
	Engineer	17.18	
	Architect	22.00	0.058
	Quantity Surveyor	15.64	
	Engineer	22.77	0.117
	Quantity Surveyor	28.98	

4.7 Barriers of Implementing Sustainability Practices during Construction Phase of Building Projects

Table 4.18 showed the relative importance index for the barriers of implementing sustainability practices for different building professionals and all of them combined together. For all of them, the result revealed that client's resistance to change with relative importance index (RII) of 0.894, lack of regulation to enforce sustainability with RII of 0.852, lack of tools and techniques to support understanding of sustainability with RII of 0.812, followed by lack of training and education in sustainable design and construction with RII of 0.81 and client's lack of interest, understanding and commitment makes it practical application difficult and lack of incorporating sustainability principle during project procurement both tied with RII of 0.806 were ranked the five major barriers. While addition of risk to project with RII of 0.616, time consuming activities with RII of 0.626, short term focus and nature of the industry with RII of 0.708, resource consumption with RII of 0.716 and insufficient professional capabilities with RII of 0.762

were ranked as the least barriers of implementing sustainability practices.

Table 4.18: Mean of all responses showing the barriers of implementing sustainability practices

Barrier of sustainability	Builder		Architect		Engineer		Qty Survey.		Overall		
	N	RII	N	RII	N	RII	N	RII	N	RII	Rank
Client's resistance to change	17	0.788	13	0.892	28	0.792	22	0.746	80	0.894	1st
Lack of regulation to enforce sustainability	17	0.824	13	0.892	28	0.822	22	0.89	80	0.852	2nd
Lack of tools and techniques to support understanding of sustainability	17	0.788	13	0.924	28	0.792	22	0.79	80	0.812	3rd
Lack of training and education in sustainable design and construction	17	0.73	13	0.8	28	0.822	22	0.864	80	0.81	4th
Client's lack of interest, understand-ing and commitment makes its practical application difficult	17	0.788	13	0.77	28	0.842	22	0.79	80	0.806	5th
Lack of incorpo-rating sustainability principle during project procurement	17	0.752	13	0.954	28	0.778	22	0.79	80	0.806	5th
Insufficient know-ledge and skill about sustainability	17	0.648	13	0.954	28	0.828	22	0.8	80	0.802	6th
High cost of	17	0.742	13	0.908	28	0.828	22	0.728	80	0.796	7th

constructing sustainably											
Insufficient professional capabilities	17	0.6	13	0.892	28	0.778	22	0.79	80	0.762	8th
Resource consumption	17	0.706	13	0.754	28	0.728	22	0.682	80	0.716	9th
Short term focus and nature of the industry	17	0.67	13	0.754	28	0.75	22	0.654	80	0.708	10th
Time consuming activities	17	0.53	13	0.77	28	0.592	22	0.666	80	0.626	11th
Addition of risk to project	17	0.612	13	0.738	28	0.572	22	0.6	80	0.616	12th

N: Number of Respondents; RII: Relative Importance Index

4.7.1 Test of Hypothesis Four on the Barriers of Sustainability Practices among the Professionals

To make a definite statement regarding the variation among building professionals on the barriers of sustainability practices, the following hypotheses were postulated to guide the study:

H_0; There are no significant differences in the perception of the barriers of sustainability practices during construction phase of building projects among Builders, Engineers, Architects and Quantity Surveyors in the study area.

H_1; There are significant differences in the perception of the barriers of sustainability practices during construction phase of building projects among Builders, Engineers, Architects and Quantity Surveyors in the study area.

To test this hypothesis, the confidence level was 95%. The decision rule was that if the p-value is less than 0.05, it means the null hypothesis is rejected and the alternative hypothesis is accepted. Otherwise, the null hypothesis is accepted and the alternative hypothesis is rejected. For this hypothesis, Kruskal Wallis test was performed to ascertain whether or not there are differences in the responses of the Builders, Architects, Engineers and Quantity Surveyors regarding the barriers of sustainability practices in the study area. The result of the test is shown in Table 4.19. In this result, majority of the variables (nine) showed p-values greater than 0.05, which by implication meant that they were not significant. The null hypothesis was accepted, while the alternative hypothesis was rejected for them. However, only four variables show p-values less than 0.05. This implied that for those four variables (which were; high cost of constructing sustainably with significance level of 0.030, insufficient professional capabilities with 0.029, insufficient knowledge and skill about sustainability with 0.016 and lack of incorporating sustainability principle during project procurement with 0.018), the null hypothesis was rejected and the alternative hypothesis was accepted.

Result from the post-hoc test as shown in Table 4.20 revealed that for high cost of constructing sustainably, the variation was attributed to the perception of the Architect and Quantity Surveyor. For insufficient professional capabilities, the perception of the Builder was the source of the variation, while for insufficient knowledge and skill about sustainability the source of variation was the perception of the Architect and for lack of incorporating sustainability principle during project procurement, the perception of the Architect was also the source of the variation.

Table 4.19: Perception on the barriers of sustainability practices among building professionals

Barriers of implementation	Designation of the respondents	N	Mean rank	Chi square	D/F	Sign.	Remark
Lack of regulation to enforce sustainability	Builder	17	38.56	1.845	3	0.605	NS
	Architect	13	40.88				
	Engineer	28	37.68				
	Quantity Surveyor	22	45.36				
High cost of constructing sustainably	Builder	17	36.88	8.963	3	0.030	S
	Architect	13	53.38				
	Engineer	28	43.45				
	Quantity Surveyor	22	31.93				
Short term focus and nature of the industry	Builder	17	35.62	4.361	3	0.225	NS
	Architect	13	45.69				
	Engineer	28	45.45				
	Quantity Surveyor	22	34.91				
Client's lack of interest, understanding and commitment makes its practical application difficult	Builder	17	38.18	0.460	3	0.928	NS
	Architect	13	39.35				
	Engineer	28	42.46				
	Quantity Surveyor	22	40.48				
Insufficient professional capabilities	Builder	17	27.74	9.026	3	0.029	S
	Architect	13	51.08				
	Engineer	28	42.64				
	Quantity Surveyor	22	41.39				
Time consuming activities	Builder	17	32.21	6.904	3	0.075	NS

	Architect	13	52.81				
	Engineer	28	37.98				
	Quantity Surveyor	22	42.84				
Lack of training and education in sustainable design and construction	Builder	17	38.38	2.149	3	0.542	NS
	Architect	13	33.96				
	Engineer	28	41.86				
	Quantity Surveyor	22	44.27				
Addition of risk to project	Builder	17	41.09	5.774	3	0.123	NS
	Architect	13	53.35				
	Engineer	28	36.02				
	Quantity Surveyor	22	38.16				
Resource consumption	Builder	17	39.12	1.422	3	0.700	NS
	Architect	13	45.38				
	Engineer	28	41.89				
	Quantity Surveyor	22	36.91				
Insufficient knowledge and skill about sustainability	Builder	17	31.00	10.347	3	0.016	S
	Architect	13	56.23				
	Engineer	28	40.88				
	Quantity Surveyor	22	38.07				
Lack of incorporating sustainability principle during project procurement	Builder	17	35.85	10.054	3	0.018	S
	Architect	13	58.08				
	Engineer	28	37.57				
	Quantity Surveyor	22	37.43				

Client's resistance to change	Builder	17	40.76	3.293	3	0.349	NS
	Architect	13	48.81				
	Engineer	28	40.79				
	Quantity Surveyor	22	35.02				
Lack of tools and techniques to support understanding of sustainability	Builder	17	35.91	6.662	3	0.083	NS
	Architect	13	54.46				
	Engineer	28	37.98				
	Quantity Surveyor	22	39.00				
Lack of regulation to enforce sustainability	Builder	17	38.56	1.845	3	0.605	NS
	Architect	13	40.88				
	Engineer	28	37.68				
	Quantity Surveyor	22	45.36				

NS: Not Significant; S: Significant; N: Number of Respondents

Table 4.20: Post-Hoc test on perception of the barriers of sustainability practices among building professionals

Barriers of implementation	Designation of the respondents	Mean rank	Sign.
High cost of constructing sustainably	Builder	13.00	0.053
	Architect	18.77	
	Builder	20.79	0.347
	Engineer	24.34	
	Builder	21.09	0.580
	Quantity Surveyor	19.16	
	Architect	24.69	0.137
	Engineer	19.29	
	Architect	23.92	0.005
	Quantity Surveyor	14.50	
	Engineer	28.82	0.051
	Quantity Surveyor	21.27	
Insufficient professional capabilities	Builder	11.71	0.005
	Architect	20.46	
	Builder	18.09	0.042
	Engineer	25.98	
	Builder	15.94	0.040
	Quantity Surveyor	23.14	
	Architect	23.73	0.284
	Engineer	19.73	
	Architect	20.88	0.163
	Quantity Surveyor	16.30	
	Engineer	25.93	0.803
	Quantity Surveyor	24.95	

Insufficient knowledge and skill about sustainability	Builder	12.09	0.008
	Architect	19.96	
	Builder	19.18	0.110
	Engineer	25.32	
	Builder	17.74	0.254
	Quantity Surveyor	21.75	
	Architect	26.85	0.018
	Engineer	18.29	
	Architect	23.42	0.008
	Quantity Surveyor	14.80	
	Engineer	26.27	0.650
	Quantity Surveyor	24.52	
Lack of incorporating sustainability principle during project procurement	Builder	11.97	0.006
	Architect	20.12	
	Builder	22.38	0.798
	Engineer	23.38	
	Builder	19.50	0.794
	Quantity Surveyor	20.39	
	Architect	27.54	0.010
	Engineer	17.96	
	Architect	24.42	0.002
	Quantity Surveyor	14.20	
	Engineer	25.23	0.877
	Quantity Surveyor	25.84	

4.8 Measures of Improving Sustainability Practices during Building Construction

Table 4.21 showed the mean item score and relative importance index for the measures of improving the implementation of sustainability practice for different professionals and all of them combined together with education and training programs for building professionals with MIS of 4.75 and RII of 0.95 ranked as the overall best measure of improving the implementation of sustainability practices. Competence and teamwork of professionals was ranked 2nd with MIS of 4.61 and RII of 0.922, closely followed by Government regulation ranked 3rd with MIS of 4.60 an RII of 0.92, information by building authorities about sustainability was ranked 4th with MIS of 4.52 and RII of 0.904, and development and mobilization of sustainable methods, tools and services was ranked 5th with MIS of 4.41 and RII of 0.882. On the other hand, the least ranked barriers were; life cycle financial analysis of cost and benefits of sustainability with MIS of 4.05 and RII of 0.81, adoption of an integrated design approach with MIS of 4.22 and RII of 0.844, incentives and initiatives with MIS of 4.24 and RII of 0.848, client's awareness and public awareness both tied with MIS of 4.25 and RII of 0.85.

Table 4.21: Mean of all responses showing the measures of improving sustainability practices

Improving measures	Builder N	Builder MIS	Architect N	Architect MIS	Engineer N	Engineer MIS	Qty Survey. N	Qty Survey. MIS	Overall N	Overall MIS	RII	Rank
Education and training programs for building professionals	17	4.65	13	4.69	28	4.89	22	4.68	80	4.75	0.95	1st
Competence and teamwork of professionals	17	4.65	13	4.92	28	4.54	22	4.50	80	4.61	0.922	2nd
Government regulation	17	4.47	13	4.62	28	4.61	22	4.68	80	4.60	0.92	3rd
Information by building authorities about sustainability	17	4.41	13	4.38	28	4.68	22	4.50	80	4.52	0.904	4th
Development and mobilization of sustainable methods, tools and services	17	4.47	13	3.77	28	4.64	22	4.45	80	4.41	0.882	5th
Client's awareness	17	4.12	13	4.62	28	4.07	22	4.36	80	4.25	0.85	6th
Public awareness	17	4.00	13	4.69	28	4.18	22	4.27	80	4.25	0.85	6th
Incentives and initiatives	17	3.88	13	3.92	28	4.43	22	4.45	80	4.24	0.848	7th
Adoption of an integrated design approach	17	4.06	13	4.46	28	4.21	22	4.23	80	4.22	0.844	8th
Life cycle financial analysis of cost and benefits of sustainability	17	3.59	13	3.77	28	4.32	22	4.23	80	4.05	0.81	9th

N: No. of Respondents; MIS: Mean Item Score; RII: Relative Importance Index

4.8.1 Qualitative Interview on Measures of Improving Sustainability Practices

Respondents were also asked of their opinion with regards to the measures that can be used to improve sustainability practices on building projects; this formed the second part of the interview. Interviewee 1 listed three factors as measures that can be used to improve sustainability practices. It is worth mentioning that embedding sustainability practices in the building approval document, statutory backing by the Government and checking of building materials to see if they are sustainable were part of the measures mentioned. The complete factors listed were as follows:

i Design, materials, products and specification submitted should be checked if they are sustainable.

ii Sustainability practices should be embedded in the conditions of contracts, programme of work and other essential document, and these documents should act as a strong basis of approval of building projects by the Government.

iii Sustainability methodology that takes into consideration the functional requirement of a building in terms of cost, time and quality should be adopted.

The view of Interviewee 2 was that there must be statutory backing by the Government by providing laws as this would help to enforce sustainability practices on building projects. In conclusion, other interviewees were in support of these measures of improving the implementation of sustainability practices in building projects, as they agreed that it will be beneficial to professionals if it becomes a standard practice.

4.9 Discussion of Results

For the purpose of examining the level of awareness of sustainability practices during construction phase of building projects among building Professionals in Akwa Ibom State, respondents were asked to rate their level of awareness of sustainability practices based on their knowledge. The result revealed that choosing the right

construction method for resource conservation and consideration of the client's satisfaction was the major sustainability practices that the respondents were aware of. Others were control of water usage, promotion of community development and local source of material, sustainable site planning and innovation and use of formwork systems to reduce the use of timber. This indicated that building professionals in Akwa Ibom State were aware of the environmental, economic and social aspects of sustainability. This result agreed with the findings of Rahim, Muzaffar, Yussoff, Zainon and Wang (2014) that sustainability principle is based not only on the pillars of environmental, but also on economic and social pillars. On the other hand, this result is contrary to previous research by Abolore (2012) and Dania, Larsen, and Yao (2013) conducted in Lagos and Abuja respectively that the understanding and awareness level of sustainability issues among practicing professionals is low and deficient.

The findings of this research have theoretically proved that building professionals in Akwa Ibom State are aware of sustainability practices during building projects. Results from the hypothesis on the perception for the level of awareness of sustainability practices among Builders, Architects, Engineers and Quantity Surveyors in the study area revealed that the p-values of nineteen variables were greater than the significance level of 0.05, hence the null hypothesis was accepted, while the alternative hypothesis was rejected. Only three variables had p-values less than 0.05 which were; control of dust to reduce pollution on building, waste management for solid excavated materials and participatory approach by involving stakeholders. The null hypothesis was rejected and the alternative hypothesis was accepted. For those three significant variables, the Post-Hoc test revealed that; for control of dust to reduce pollution on building, the perception of the Architect was the source of the variation. While for waste management for solid excavated materials, the source of variation was the perception

of the Builder and for participatory approach by involving stakeholders, the perception of the Architect was the source of the variation. From the analysis, consideration of the client's satisfaction was investigated to be the highest sustainability practices implemented during construction phase of building projects. Choosing the right construction method for resource conservation, provision of equal employment opportunities, promotion of community development and local source of materials and control of water usage were other sustainability practices implemented during building projects. This was an indication that the level of implementation of the economic aspect of sustainability practices in building projects is high in Akwa Ibom State. This result was therefore in agreement with Presley and Meade (2010) and Ochieng *et al.* (2014) who asserted that client's satisfaction is a sustainability indicator at project level, as construction clients are increasingly requiring business consultants, contractors and suppliers to adopt sustainability policies in construction process.

The result also supported the assertion of Abolore (2012) and Ochieng *et al.* (2014) that the practical implementation and integration of sustainability principles; economic, social and environmental into construction projects is significant to manage the current environmental issue and attain significant improvements in performance and improve project delivery. Results from the hypothesis on the perception for the level of implementation of sustainability practices among Builders, Architects, Engineers and Quantity Surveyors in the study area revealed that the p-values of eleven variables were greater than 0.05, hence the null hypothesis was accepted while the alternative hypothesis was rejected. Eleven variables had p-values less than 0.05 which were; control of dust to reduce pollution on building, control of water usage, use of alternative sources or devices for energy savings, choosing the right construction method for resource conservation, use of formwork system to reduce the use of timber, use of

environmentally friendly cleaning products on sites, sustainable site planning waste management for solid excavated materials, use of life cycle costing in building projects, employment and retention of labour and provision of equal employment opportunities. The null hypothesis was rejected and the alternative hypothesis was accepted for them. The Post-hoc test conducted for the eleven significant variables revealed that, for control of dust to reduce pollution on building the perception of the Engineer was the source of variation. For control of water usage, the perception of the Architect was the source of the variation. The source of variation for use of alternative energy sources or devices for energy savings came from the perception of the Builder and Engineer, while for choosing the right construction method for resource conservation was from the Builder and Architect, use of formwork systems to reduce the use of timber came from the perception of the Builder. The perception of the Builder and Architect on the use of environmentally friendly cleaning products and pesticides on sites was the source of the variation and for sustainable site planning and innovation the variation came from the Engineer. For waste management for solid excavated materials, the perception of the Engineer and Quantity Surveyor was the source of the variation, for use of life cycle costing in building projects, the variation came from the Builder, while for employment and retention of labour, the perception of the Builder and Architect was the source of the variation and for provision of equal employment opportunities, the variation came from the perception of the Architect.

To determine the drivers for implementing sustainability practices, respondents were asked to rank the variable that drives its implementation. Findings of this research revealed that regulation by the Government is the highest driving factor for implementing sustainability practices. This agreed with the observations of Shafii, Ali and Othman (2006) and Thivaharan (2015) that regulatory framework, Government

regulations and policies are the driving force of sustainability practices. The result also supported the assertion of Hakkinen and Belloni (2011) that sustainability can be promoted at least to a certain extent with the help of regulation. Futhermore, this result also agreed with the observation of Abolore (2012) that the Nigerian Government has a role in encouraging sustainability as these will prompt interest among construction players. Results from the hypothesis on the perception of the drivers for sustainability practices among Builders, Architects, Engineers and Quantity Surveyors in the study area revealed that the p-values of eleven variables were greater than the significance level of 0.05, hence the null hypothesis was accepted while the alternative hypothesis was rejected. Eight variables had p-values less than 0.05 which were; branding and reputation, use of integrated approach, client’s awareness and knowledge, value added benefits and operational efficiency, education and training programs, public – private collaborative partnership, empowering project team members to develop innovative solutions and new client procurement policies. The null hypothesis was rejected and the alternative hypothesis was accepted.

For those eight significant variables, the Post-Hoc test revealed that for branding and reputation, the Achitect was the source of the variation. For use of integrated approach, the variation came from the perception of the Architect and Quantity Surveyor, while for client’s awareness and knowledge the source of variation was attributed to the Architect and for value added benefits and operational efficiency the perception of the Architect and Engineer was the source of the variation. For education and training programs by academicians, the Builder and Engineer was the source of the variation while the perception of the Builder, Architect, Engineer and Quantity Surveyor on public – private collaborative partnership was the source of the variation. The perception of the Architect on empowering project team members to develop innovative solution

contributed to the variation and for new client procurement policies the variation also came from the Architect.To investigate the barriers of implementing sustainability practices, respondents were asked to rank the barriers. The result showed that client's resistance to change was the major barrier of implementing sustainability practices in building project. This finding was consistent with previous research by Landman (1999) and Ochieng *et al.* (2014) that lack of interest from clients is the most significant barrier to widespread sustainability in building practice and in most cases clients lacked the information they need to make choices about which development would be more or less sustainable. The result of this finding was however contrary to previous research by Al-Yami and Price (2006) and Tan, Shen and Yao (2011) that increase in cost is the main barrier to the implementation of sustainability in construction and this discourages contractors from engaging actively in improving their sustainability performance.

The findings of this study have thus cleared the common perception about sustainability in construction project compared to traditional building projects that the risk of unforeseen high cost hinders its implementation. Building professionals can now overcome this barrier by understanding the need for sustainability, and changing their thinking from cost to value and from short-term to long-term. Results from the hypothesis on the perception of the barriers of sustainability practices among Builders, Architects, Engineers and Quantity Surveyors in the study area revealed that the p-values of nine variables were greater than 0.05, therefore the null hypothesis was accepted while the alternative hypothesis was rejected. Only four variables had p-values less than 0.05 which were; high cost of constructing sustainably, insufficient professional capabilities, insufficient knowledge and skill about sustainability and lack of incorporating sustainability principle during project procurement. The null hypothesis

was rejected and the alternative hypothesis was accepted for them as well. The Post-Hoc test revealed that for high cost of constructing sustainably, the variation was attributed to the perception of the Architect and Quantity Surveyor. For insufficient professional capabilities, the perception of the Builder was the source of the variation, while for insufficient knowledge and skill about sustainability the source of variation was the perception of the Architect and for lack of incorporating sustainability principle during project procurement, the perception of the Architect was also the source of the variation.

The survey also developed measures to be adopted to improve the implementation of sustainability practices. The result revealed that education and training programs for building Professionals was the best measure of improving the implementation of sustainability practice. This agreed with the observations of Abolore (2012), Shafii, Ali and Othman (2006) that educating and training building professionals in sustainability concepts and methods are the most essential ways of encouraging more widespread sustainability in construction. The result also supported the assertion of Landman (1999) that educating all segments of the society about the need for sustainable building, and secondarily, training building professionals in sustainability concepts and methods are the most essential ways of encouraging more widespread sustainability in construction projects. Life cycle financial analysis of cost and benefits of sustainability was indicated as the least measure of improving sustainability practices. This finding was therefore consistent with previous research by Landman (1999) that conducting life cycle financial analysis of cost and benefits is one of the measures for sustainability in construction projects.

This chapter analysed all the questions in the questionnaire in order to achieve the aim and objectives of this research. The level of awareness of sustainability practices, its

level of implementation, the drivers, barriers and measures of improving the implementation of sustainability practices were deduced and discussed in detail. This chapter also presented the result of the hypothesis regarding the perception among building professionals in the study area. By carrying out discussions on the data collected, conclusions and recommendations were drawn from them. This was presented in the following chapter.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Preamble

The aim of the study was to assess the level of implementation of sustainability practices during construction phase of building projects. To accomplish this aim, a number of objectives guided by research questions were set. In this chapter, the objectives were revisited to bring into light the extent to which the objective of the study was achieved throughout the various phases of the study by summarising the findings. This chapter also gave the conclusions from the findings of the study and the recommendations that follow. The area for further research concluded the chapter.

5.2 Summary of Findings

The findings from the analysis have revealed the level of awareness of sustainability practices during construction phase of building projects. The result showed that choosing the right construction method for resource conservation and consideration of the client's satisfaction is the major sustainability practices that building professionals were aware of in the study area. It was also suggested that control of water usage, promotion of community development and local source of material, sustainable site planning and innovation are other sustainability practices. Above all, it was safe to say that the awareness level of sustainability practices in the study area was high. Findings on the perception of the level of awareness of sustainability practices among Builders, Architects, Engineers and Quantity Surveyors in the study area revealed that nineteen variables which showed p-values greater than 0.05 were not significant, while variation occurred with three variables; control of dust to reduce pollution on building, waste management for solid excavated materials and participatory approach by involving stakeholders were significant with showed p-values less than 0.05. For those three

significant variables, the Post-Hoc test revealed that; for control of dust to reduce pollution on building, the perception of the Architect was the source of the variation. While for waste management for solid excavated materials, the source of variation was the perception of the Builder and for participatory approach by involving stakeholders, the perception of the Architect was the source of the variation.

On the level of implementation of sustainability practices, the result showed that consideration of the client's satisfaction was ranked as the highest sustainability practices implemented by building professionals. Choosing the right construction method for resource conservation and provision of equal employment opportunities were other sustainability practices that are implemented on building project in Akwa Ibom State. It was revealed through interviewees that planting trees and grasses on site, health and safety management/best practice, extensive allowance for green areas and trees as opposed to hard stands and pavements, carrying out community development project to impact the environment, planting ornamental plant and grass for landscaping purposes, reduction in the use of toxic materials during construction and use of steel formwork systems to reduce the use of timber were other sustainability practices implemented on construction site and building professionals were implementing these practices subconsciously during building projects.

Findings on the perception of the level of implementation of sustainability practices among Builders, Architects, Engineers and Quantity Surveyors in the study area revealed that no significant differences occurred with eleven variables which showed p-values greater than 0.05, while eleven variables were also significant which had p-values less than 0.05. Results from the Post-hoc test conducted for those eleven significant variables revealed that, for control of dust to reduce pollution on building the perception of the Engineer was the source of variation. For control of water usage, the perception

of the Architect was the source of the variation. The source of variation for use of alternative energy sources or devices for energy savings came from the perception of the Builder and Engineer, while for choosing the right construction method for resource conservation was from the Builder and Architect, use of formwork systems to reduce the use of timber came from the perception of the Builder. The perception of the Builder and Architect on the use of environmentally friendly cleaning products and pesticides on sites was the source of the variation and for sustainable site planning and innovation the variation came from the Engineer. For waste management for solid excavated materials, the perception of the Engineer and Quantity Surveyor was the source of the variation, for use of life cycle costing in building projects, the variation came from the Builder, while for employment and retention of labour, the perception of the Builder and Architect was the source of the variation and for provision of equal employment opportunities, the variation came from the perception of the Architect.

The study revealed that regulation by the Government was the driving factor for the implementation of sustainability practices. Client's awareness and knowledge, and knowledge and information sharing by building authorities were found to be other driving factors in implementing sustainability practices on building projects in Akwa Ibom State. On the perception for the drivers for sustainability practices among Builders, Architects, Engineers and Quantity Surveyors in the study area, it was revealed that there were no significant variation on eleven variables which showed p-values greater than 0.05, while significant variation was recorded with eight variables; branding and reputation, use of integrated approach, client's awareness and knowledge, value added benefits and operational efficiency, education and training programs for academicians, public – private collaborative partnership, empowering project team members to develop innovative solutions and new client procurement policies which all showed p-

values less than 0.05. The Post-Hoc test revealed that for branding and reputation, the Achitect was the source of the variation. For use of integrated approach, the variation came from the perception of the Architect and Quantity Surveyor, while for client's awareness and knowledge the source of variation was attributed to the Architect and for value added benefits and operational efficiency the perception of the Architect and Engineer was the source of the variation. For education and training programs by academicians, the Builder and Engineer was the source of the variation while the perception of the Builder, Architect, Engineer and Quantity Surveyor on public – private collaborative partnership was the source of the variation. The perception of the Architect on empowering project team members to develop innovative solution contributed to the variation and for new client procurement policies the variation also came from the Architect.

The research further revealed that client's resistance to change was the major barrier of implementing sustainability practices. Other barriers hindering the implementation of sustainability practices in the study area were lack of regulation to enforce sustainability and lack of tools and techniques to support understanding of sustainability. Respondents also attributed poor attitude of workers towards sustainability practices as a barrier toward its implementation. Findings on the perception of the barriers of sustainability practices among Builders, Architects, Engineers and Quantity Surveyors in the study area revealed that there were no significant differences on nine variables which showed p-values greater than 0.05, while four variables; high cost of constructing sustainably, insufficient professional capabilities, insufficient knowledge and skill about sustainability and lack of incorporating sustainability principle during project procurement were significant with p-values less than 0.05.

For those four variables that were significant, the Post-Hoc test revealed that for high; cost of constructing sustainably, the perception of the Architect and Quantity Surveyor was the source of the variation. For insufficient professional capabilities, the perception of the Builder was the source of the variation, while for insufficient knowledge and skill about sustainability the source of variation was the perception of the Architect and for lack of incorporating sustainability principle during project procurement, the perception of the Architect was also the source of the variation.

The study also developed measures of improving the implementation of sustainability practices in Akwa Ibom State. Education and training programs for building professionals, competence and teamwork of professionals and Government regulation were indicated as the most effective measures to be adopted. Also, findings from the interview shows that sustainability practices needs to be embedded in the conditions of contracts and a system to adequately vet the design, materials and specification for sustainability in construction must be put in place, as well as the existence of statutory backing by the Government by providing laws and regulations to enforce sustainability practices during construction phase of building projects.

5.3 Conclusion

Construction activities will continue to negatively impact our environment, unless the concept of sustainability is fully implemented during building projects. It is believed that this study has contributed to the body of knowledge in this area, specifically by assessing the level of implementation of sustainability practices during construction phase of building projects which have been the main aim of this research work. The appraisal has provided meaningful insight into sustainability practices that are being implemented on building projects as well as the drivers, barriers and measures of

improving its implementation in Akwa Ibom State. The main findings of this study revealed that choosing the right construction method for resource conservation and consideration of the client's satisfaction are the key sustainability practices. It was discovered that the level of awareness of sustainability practices is high in the study area and these practices are subconsciously implemented in building projects. The findings also revealed that regulation by the Government play a central role in driving the implementation of sustainability practices. Client's resistance to change was however revealed to be the major barrier to its implementation. The study concluded that education and training programs for building professionals is needed to improve the implementation of sustainability practices in the study area. To this end, the recommendations submitted in this research is poised to assist building professionals and clients in implementing sustainability practices in their building projects.

5.4 Recommendations

On the basis of the findings in this research, the following recommendations are therefore developed as measures of improving the implementation of sustainability practices in Akwa Ibom State.

- Professional bodies such as Council of Registered Builders of Nigeria, Architects Registration Council of Nigeria, Council of Registered Engineers of Nigeria and Quantity Surveying Registration Board of Nigeria should institute training programs, seminars, workshops and conferences to educate building professionals to implement sustainability practices during building projects. Academicians in the learning environment are also encouraged to introduce the concept of sustainability into university curriculum as part of the effort to create awareness to future professionals.

- Building professionals and clients should endeavour to improve their knowledge and understanding of sustainability so as to enhance their competence in implementing sustainability practices during building construction projects.

- The Government through the Ministry of Urban Renewal and Ministry of Works in Akwa Ibom State should provide regulations that embed sustainability practices in building approval documents and this document should act as a strong basis for the approval of building projects.

- Building authorities such as the Uyo Capital City Development Authority should provide information about sustainability which should be included at all levels to assist building professionals in implementing sustainability practices.

- The approved building agencies in Akwa Ibom State should develop and mobilize sustainability methods, tools and services that support the implementation of sustainability practices, and Building professionals should be encouraged to use this methodologies especially those that takes into account the functional requirement of a building.

- The Government through the Ministry of Urban Renewal, Ministry of Works and the Uyo Capital City Development Authority should provide a system that vets the design, building materials and specifications to ascertain if they are sustainable before usage.

5.5 Areas for Further Research

Numerous research avenues have arisen as a result of carrying out this study. The following were therefore recommended for further research:

- Relationship between traditional method of construction and sustainable construction method.
- Methods and tools for implementing sustainability practices on building projects in Akwa Ibom State.
- Further research into Government's role in implementing and promoting sustainability practices in Nigeria.
- The role of Building Professionals in executing sustainable projects in Nigeria

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APPENDICES

Department of Building
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Akwa Ibom State

QUESTIONNAIRE

Dear Respondent,

We would very much appreciate it if you could take time to contribute to an on-going Masters dissertation on "**Appraisal of the Implementation of Sustainability Practices during Building Construction Projects in Akwa Ibom State**" in the Department of Building, Faculty of Environmental Studies, University of Uyo.

The research aims to assess the level of implementation of sustainability practices during construction phase of building projects with a view to improving the implementation of sustainability practices in building projects for improved building performance and resource efficiency. Data to be collected from this questionnaire survey will be used for academic purpose only and treated with utmost confidentiality.

We would like to thank you very much for your invaluable help and contributions to the research. We look forward to hearing from you soon.

Yours Faithfully,

Inimbom Walter Isang	Dr. Michael G. Oladokun
Postgraduate Student	Supervisor
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Telephone: 08069036180	Telephone: 08068132559

SECTION A: RESPONDENT'S CHARACTERISTICS

Please tick or specify your area as indicated

1. Building Professional's Work Specialization

i.	Public Sector	☐
ii.	Private Sector	☐

2. Nature of Executed Building Projects

i.	Educational	☐
ii.	Commercial	☐
iii.	Industrial	☐
iv.	Residential	☐
v.	Others (Specify)	....

3. Designation of the Respondent

i.	Builder	☐
ii.	Architect	☐
iii.	Engineer	☐
iv.	Quantity Surveyor	☐
v.	Others (Specify)	....

4. Highest Academic Qualification

i.	OND	☐
ii.	HND	☐
iii.	B.Sc	☐
iv.	M.Sc	☐
v.	Ph.D	☐
vi.	Others (Specify)	....

5. Professional Affiliation

i.	CORBON	☐
ii.	ARCON	☐
iii.	COREN	☐
iv.	QSRBN	☐
v.	Others (Specify)	....

6. Years of Experience in executing building projects

i.	1 – 5 years	☐
ii.	6 – 10 years	☐
iii.	11 – 15 years	☐
iv.	Above 15 years	☐

SECTION B: AWARENESS OF SUSTAINABILITY PRACTICES DURING BUILDING CONSTRUCTION

7. Please tick (✓) the following Sustainability Practices that you are aware of based on your knowledge.

Sustainability Awareness		Yes 1	No 2	Not Sure 3
1	Recycling and reuse of materials			
2	Control of dust to reduce pollution on building.			
3	Control of water usage			
4	Control of carbon emissions			
5	Use of alternative energy sources or devices for energy savings.			
6	Choosing the right construction method for resource conservation.			
7	Use of formwork systems to reduce the use of timber.			
8	Use of environmentally friendly cleaning products and pesticides on sites.			
9	Sustainable site planning and innovation			
10	Use of noise barriers at site			
11	Use of vertical green wall at the site to cool the office			
12	Waste management for solid excavated materials			
13	Indoor environmental quality			
14	Controlling the use and dispersion of toxic materials			
15	Considering the impact of projects on air, soil and water			
16	Use of renewable materials			
17	Use of life cycle costing in building projects			
18	Consideration of the client's satisfaction			
19	Employment and retention of labour			

20	Participatory approach by involving stakeholders			
21	Provision of equal employment opportunities			
22	Promotion of community development and local source of material.			

⇨ From your knowledge, comment if there are any other sustainability practices that you are aware of. (if no, please specify as none)

SECTION C: IMPLEMENTATION OF SUSTAINABILITY PRACTICES DURING BUILDING CONSTRUCTION Please rank your level of implementation of the following Sustainability Practices.

Legend: 5 = Very High, 4 = High, 3 = Moderate, 2 = Low and 1 = Very Low.

8. To what extent do you as a Building Professional implement this Sustainability Practices in your building projects?

Sustainability Practices		Very High 5	High 4	Moderate 3	Low 2	Very Low 1
1	Recycling and reuse of materials					
2	Control of dust to reduce pollution on building					
3	Control of water usage					
4	Control of carbon emissions					
5	Use of alternative energy sources or devices for energy savings					
6	Choosing the right construction method for resource conservation.					
7	Use of formwork systems to reduce the use of timber.					
8	Use of environmentally friendly cleaning products and pesticides on sites.					
9	Sustainable site planning and innovation					

10	Use of noise barriers at site					
11	Use of vertical green wall at the site to cool the office and improve aesthetics					
12	Waste management for solid excavated materials					
13	Indoor environmental quality					
14	Controlling the use and dispersion of toxic materials					
15	Considering the impact of projects on air, soil and water					
16	Use of renewable materials					
17	Use of life cycle costing in building projects					
18	Consideration of the client's satisfaction					
19	Employment and retention of labour					
20	Participatory approach by involving stakeholders					
21	Provision of employment opportunities					
22	Promotion of community development and local source of material.					

⇨ From your experience, comment if there are any other sustainability practices that you have implemented in your building projects. (if no, please specify as none)

SECTION D: DRIVERS AND BARRIERS OF IMPLEMENTING SUSTAINABILITY PRACTICES IN BUILDING PROJECTS

Please rank your level of agreement of the following Sustainability Practices.

Legend: 5 = Strongly Agree, 4 = Agree, 3 = Neither Agree nor Disagree, 2 = Disagree and 1 = Strongly disagree.

9. What factors would drive you as a Building Professional to implement this Sustainability Practices in building projects?

	Drivers for Implementation	Strongly Agree 5	Agree 4	Neither Agree nor Disagree 3	Disagree 2	Strongly Disagree 1
a.	Regulations by the Government					
b.	Branding and enhanced reputation					
c.	Use of integrated approach					
d.	Development of technologies and tools for sustainability requirement					
e.	Client's awareness and knowledge					
f.	Cost reduction					
g.	Value added benefits and operational efficiency.					
h.	Evidence of environmental damage.					
i.	Commitment by professionals and stakeholders					
j.	Education and training programs by academicians					
k.	Public – private collaborative partnership					
l.	Empowering project team members to develop innovative solutions					
m.	Ethics and behavioural change					

n.	Integration of Environmental Management System					
o.	Public awareness					
p.	New client procurement policies					
q.	Knowledge and information sharing by building authority					
r.	Owners' commitment to sustainability					
s.	Introducing green objectives early					
t.	Others (Specify)					

10. Please rank your level of agreement about the following barriers of implementing sustainability practices during building construction projects.

Barriers to Implementation		Strongly Agree 5	Agree 4	Neither Agree nor Disagree 3	Disagree 2	Strongly Disagree 1
a.	Lack of regulation to enforce sustainability.					
b.	High cost of constructing sustainably.					
c.	Short term focus and nature of the industry					
d.	Client's lack of interest, understanding and commitment makes its practical application difficult.					
f.	Insufficient professional capabilities.					
g.	Time consuming activities					
h.	Lack of training and education in sustainable design and construction					
i.	Addition of risks to project.					
j.	Resource consumption					
k.	Insufficient knowledge and skill about sustainability					

l.	Lack of incorporating sustainability principle during project procurement					
m.	Client's resistance to change					
n.	Lack of tools and techniques to support understanding of sustainability					
o.	Others (Specify)					

SECTION E: MEASURES OF IMPROVING SUSTAINABILITY PRACTICES

11. Please rank your level of agreement of the following measures of improving the implementation of sustainability practices in building projects.

Measures of Improving Sustainability Practices		Strongly Agree 5	Agree 4	Neither Agree nor Disagree 3	Disagree 2	Strongly Disagree 1
a.	Education and training programs for building professionals.					
b.	Government regulation					
c.	Incentives and initiatives					
d.	Life cycle financial analysis of cost and benefits of sustainability.					
e.	Development and mobilization of sustainable methods, tools and services.					
f.	Client's awareness					
g.	Competence and teamwork of professionals					
h.	Adoption of an integrated design approach					
i.	Public awareness					

j.	Information by building authorities about sustainability					

⇨ From your experience, comment if there are any other measures that can be used to improve sustainability practice in building projects. (if no, please specify as none)

APPENDIX II

QUALITATIVE INTERVIEW

PART 1

1. From your experience in construction projects, are sustainability practices being implemented in the building projects you are currently executing and what are some of this practices?

PART 2

2. From your knowledge of sustainability practices, what measures can be used to improve its implementation on building projects?

APPENDIX III

DETERMINATION OF SAMPLE SIZE FOR THE BUILDING PROFESSIONALS

The Taro Yamane formula is expressed as;

$$n = \frac{N}{1 + N (e)2}$$

Where n = Sample size

N = Population of the study

e = Level of precision (0.05%)

For Architects; $n = \frac{49}{1 + 49 (0.05)^2} = 44$

Builders; $n = \frac{30}{1 + 30 (0.05)^2} = 28$

Civil/Structural Engineers; $n = \frac{149}{1 + 149 (0.05)^2} = 109$

Mechanical Engineers; $n = \frac{105}{1 + 105 (0.05)^2} = 83$

Electrical Engineers; $n = \frac{95}{1 + 95 (0.05)^2} = 77$

Quantity Surveyors; $n = \frac{47}{1 + 47 (0.05)^2} = 42$

About The Author

Inimbom Isang is the Author of the academically acclaimed masterpiece "Appraisal of the Implementation of Sustainability Practices during Construction Phase of Building Projects in Akwa Ibom State", a scholarly work that have made significant contributions to the awareness of Sustainable Construction in Nigeria. As an Occasional Published Author, he has several publications to his credit and is a Reviewer for the European Scientific Journal.
Visit https://about.me/inimbomisang for more about this Author.

Also by Inimbom Isang

Project
Investigating the Factors Affecting the Performance of Construction Projects in Akwa Ibom State (2011). B.Sc Dissertation, Department of Quantity Surveying, Faculty of Environmental Studies, University of Uyo.
Available at: https://independentresearcher.academia.edu/InimbomIsang

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